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COLONEL W. H. HORROCKS, C.B.

ASSISTED BY

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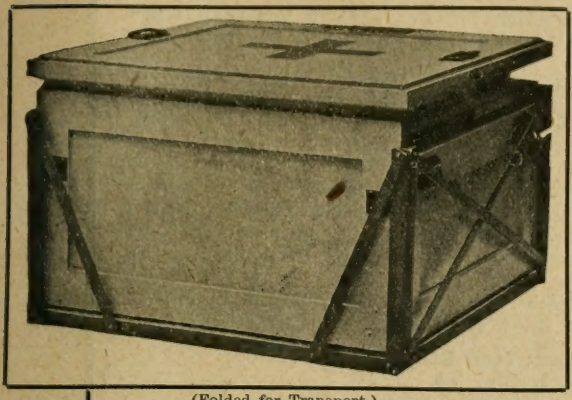

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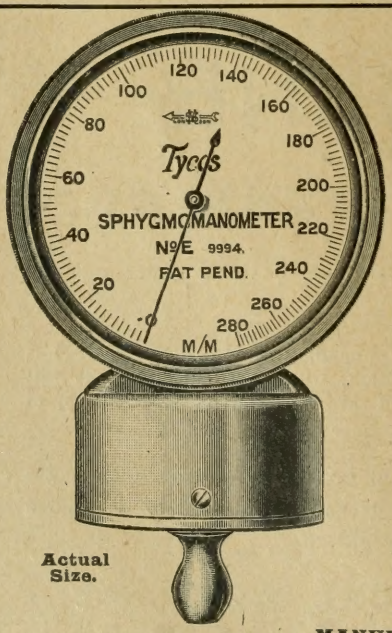

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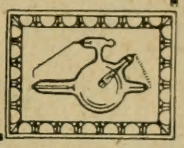

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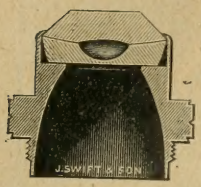

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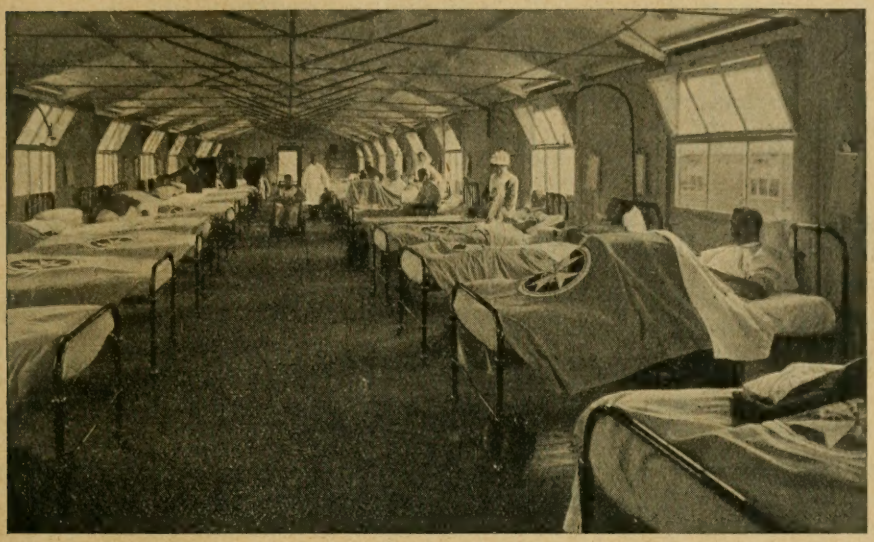

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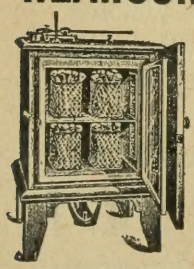

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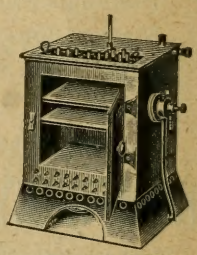

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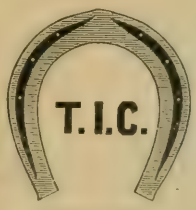

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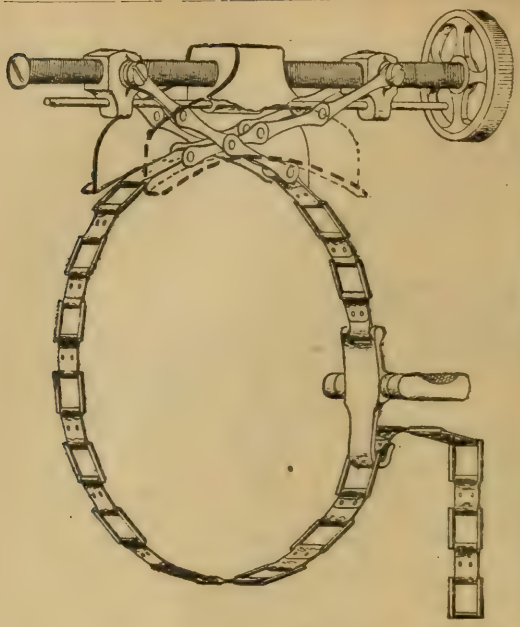

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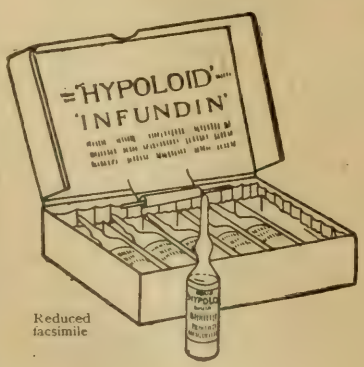

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THE SYMPTOMS OF ACUTE CEREBELLAR INJURIES AS OBSERVED IN WARFARE.

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THE functional defects which are produced by injury or disease of the cerebellum have been described by many physiologists and clinicians, and almost innumerable attempts have been made to analyse and solve their significance and thereby determine the normal functions of this organ. But there is still a remarkable divergence between the symptoms attributed to lesions of the cerebellum in man in various text-books and monographs and the phenomena which physiologists have observed after its injury or ablation in animals. It is, however, obvious that a close correspondence must be established between them before clinical experience can contribute to the solution of the physiological significance of the cerebellum, and before we can determine the part which this plays in the human nervous mechanism.

The opportunity of making uncomplicated clinical observations is rare in civil life, since acute lesions of the cerebellum, comparable with those produced by physiologists, are uncommon; tumours and abscesses which develop in it are very liable to compress or to influence the functions of other parts; softenings and hæmorrhages are rarely wholly limited to it, and the degenerative and atrophic diseases which involve it practically never affect it alone. In warfare, on the other hand, wounds limited to the cerebellum and injuries of it of different extent and localization can be frequently observed. During the present War I have been able to examine over forty men in whom it had been injured, but as wounds of this region of the head are notoriously serious a certain number died early, in others the symptoms were only slight or transient, and many were of

necessity evacuated to England within a short time of the infliction of the injury. Twenty-one patients in whom the symptoms were pronounced remained, however, under observation sufficiently long to permit repeated examination and investigation. In several of these the wounds had healed and they were able to leave bed and walk before they were transferred; some of the more serious cases in fact remained under observation for two to three months.

My investigations have been consequently made chiefly in the early and acute stages of injuries of the cerebellum, but in many cases the recovery of function, or "compensation," could be also studied. I was particularly fortunate in being able to examine, before this paper was completed, two men in whom the lesions were of much longer standing. One, in an attempt to commit suicide eight years previously, had shot himself through his mouth and produced extensive destruction of one lateral lobe of the cerebellum, in which fragments of metal still remained. The other had been wounded by a fragment of shell-casing twenty months previously and had been trephined over one lateral lobe. Both patients still presented symptoms of cerebellar disturbance, but unfortunately the second man had developed signs of disseminated sclerosis. In a third case, which also came under my observation, the characteristic symptoms of a very severe unilateral cerebellar lesion had come on suddenly while he was under heavy gun fire. I have not included these three cases in my series, but I have been able to control many observations made in acute cases on them. My observations have been made, therefore, on injuries which resemble closely those on which the classical physiological descriptions are based, and it will consequently not be surprising that a close similarity exists between them. The chief divergencies probably depend on the position of the subject in the phylogenetic scale, and on the relative importance or subordination of the cerebellum in the nervous system of different animals.

In the subsequent pages it will be my aim to describe those disturbances of function which constitute the symptoms of recent cerebellar lesions as objectively as possible, and to attempt to analyse complex symptoms into their simpler components. Names and terms applied to symptoms will be employed as rarely as possible, and as the defects of function can be often most easily understood by observing abnormalities in the ordinary or spontaneous activities of the affected parts, clinical tests have been made use of only sparingly or have been supplemented by further observations.

It is, however, impossible to deal with this subject without relying largely on Babinski's masterly analysis of cerebellar symptoms and on the careful descriptive work of other neurologists, especially André-Thomas, who has also attempted a valuable correlation of these clinical symptoms with the disturbances that occur in animals after experimental injury. If

the references to their work are incomplete it must be attributed to the circumstances under which this contribution has been written.

In the majority of my patients who survived, the lesions were unilateral and involved only, or chiefly, one lateral lobe of the cerebellum; the descriptions of the resulting symptoms will be consequently based largely on these cases. Certain patients with extensive bilateral lesions were, however, also observed.

Unilateral Lesions of the Cerebellum.

(1) *Disturbance of Tone.*

The effects of cerebellar injuries fall almost exclusively upon the motor system, and in the early stages of an acute lesion one of the most prominent symptoms is loss or diminution of tone in the muscles of the limbs, and to a less extent in those of the trunk, of the same side.

If a case in which there is an extensive unilateral lesion be examined within the first week or two, one of the most striking features is the flabbiness of the muscles of the homolateral arm to palpation; as compared with those of the opposite side they are more easily compressed and displaced transversely, and they can be stretched or elongated to a greater extent without any discomfort to the patient. This is obviously the reason why the limbs often assume unnatural attitudes or are placed in postures which the patient would tend to avoid, in a normal limb. Not infrequently, for instance, the hand may be observed lying for long periods prone on the bed with the fingers fully straightened out or even hyperextended, although this unnatural attitude can be easily corrected; and this is probably the explanation of the fact, that on attempting to rise into the sitting position in bed the patients occasionally help themselves by throwing their weight on the dorsum of the affected hand, so that the fingers and wrist are overflexed to an extent that would be uncomfortable or even painful in the normal limb. An officer, for instance, who was dull and restless for a few days afterwards complained that the knuckles and the wrist of his affected hand were sore, owing to the fact that in attempting to sit up in bed he usually placed this hand under him in the flexed position. This phenomenon cannot be attributed to loss of sensation, since repeated examinations have failed to reveal alteration in any of its modalities; it is analogous to the failure to correct instantly unnatural attitudes of the limbs, which Luciani has described after partial or total ablation of the cerebellum in animals.

If in such a patient both forearms are held vertically by the observer the wrist of the affected side usually falls passively into a position of extreme flexion, while in the normal limb the wrist is not allowed to become more than semiflexed owing to the tone of its extensor muscles (fig. 1). Similarly if as the patient lies in bed his arms are fully abducted and rotated out-

wards so that his hands lie behind his head, the affected wrist is more fully extended by its own weight than is its fellow, and the arm is often excessively rotated too.

When such a limb is handled and moved about passively it is at once obvious that there is loss of that slight but definite resistance that normal muscles offer to stretching. Further, if either the arms or the legs are seized and shaken it is found that the more distal segments of the affected limbs flop and swing about in an unnatural inert manner like the arm of a flail. This can be easily seen, but the abrupter jar which the arrest of the freely swinging segments communicates to the observer's hand is often even more unmistakable. Another striking feature brought out by this manœuvre is, that while the oscillations of the distal segments of the normal limb are limited by the elastic tension of the muscles that are

FIG. 1.—A case of extensive injury of the left side of the cerebellum; photograph taken one week after the infliction of the wound. When the forearms were held vertically the left wrist flexed under the influence of gravity much more than the right.

stretched, those of the other limb can be felt to swing till the joints "lock," and their bony and ligamentous structures prevent their further movement. This "locking" of the joints can be most easily felt at the wrist, elbow, and the ankle. There is never, however, any evidence of articular or ligamentous relaxation which permits a greater range of absolute movement, such as occurs in tabes dorsalis.

The same phenomena may be observed by rotating or otherwise suddenly displacing the patient's whole body when he can stand erect, for the affected arm swings about inertly as though it were only tied to the shoulder by a string. (André-Thomas.)

In rapid voluntary movement, too, an excessive passive swing at certain joints not directly concerned in the action can be often observed. When for instance the patient is asked to flex and extend his supported elbows as quickly as possible, as in testing for adiadochokinesis, the affected wrist

is successively overflexed and overextended owing to the momentum of the movement, so that the hand is flung against the shoulder or towards the bed. The fact that in this test the affected elbow is often raised from its support by the momentum of the flexing forearm is also due to deficient tension in those muscles that should fix the shoulder-joint.

And if the forearms are seized by the observer, and suddenly flipped as if he were cracking a whip, the wrists flex passively, but while the normal hand is immediately extended again owing to the elasticity of its extensors, the affected one remains flexed or only swings inertly. This may be seen at the ankle too if the relaxed leg is similarly jerked and arrested abruptly. Finally, if a patient in this stage holds his two arms horizontally outstretched and the normal limb is gently tapped by the observer's fingers, it is but little displaced and immediately regains its original position, but the affected arm swings more widely as a result of each blow, offers less resistance to displacement, is arrested less abruptly, and is slower in its return (André-Thomas). In this test the displacement is generally due to movement at the shoulder, but if the hand is more forcibly tapped the wrist and the elbow often flex too.

This diminution in elastic resistance of muscles to stretching can be often observed directly. If the fingers are seized and passively extended at the same time as the wrist they can be easily, and without the observer experiencing any resistance, bent back till further movement becomes impossible owing to the conformation of the joints and the tension on their ligaments; and even in this position the patient does not experience the dull pain or discomfort in the overstretched flexor muscles which he suffers when the unaffected wrist and fingers are forcibly extended to the same degree. This may be also observed at the elbow, shoulder, and in the joints of the lower limb. The affected heel can be for instance easily brought into apposition with the buttock, or the thigh can be so fully flexed that the knee touches the chest (fig. 2). Consequently, though the maximum possible range of passive movement may not be increased, the normal resistance offered to it by the muscles when they are passively elongated is deficient, and definite resistance is felt only when the rigid ligaments or the apposed bones restrict the movements. As a rule this diminished elasticity of the muscles becomes more obvious about five to ten days after the infliction of the wound, and in cases of severe injury it may persist for several weeks at least.

We therefore find on palpation, passive movement, shaking and tapping of the affected limbs, that their muscles are soft and flabby, and that their tension, which normally tends to oppose passive movement and prevent that unrestricted swinging under the influence of gravity or displacement of their different segments, such as occurs in a hinged skeleton, is diminished. In other words, there is loss of that active tension which

distinguishes normal muscles and is independent of their length, that is known as *tone*.

This flabby hypotonic state of the muscles suggested the examination of their reaction to direct percussion. This was done in several cases but no definite difference could be detected.

When an extensive unilateral lesion of the cerebellum exists this state of hypotonia is always limited to the same side, but it is usually more pronounced, or at least more easily demonstrated, in the upper than in the lower limb. Distal and proximal muscles are involved to relatively the same degree. It is less easy to demonstrate in the trunk muscles, but here too

FIG. 2.—A case of severe injury of the right lateral lobe and of the right side of the vermis, ten weeks after the infliction of the wound. The right thigh can be fully flexed on to the trunk, the heel placed on the buttock, and the foot much dorsiflexed with the exertion of very little power.

the stretching of those of the side of the lesion offers less resistance, as the patient sits or stands, than those of the unaffected side. It does not produce any appreciable asymmetry or other change in the face. In smaller lesions it is generally demonstrable in both the upper and lower limbs, but it is less pronounced, especially in the latter.

Its distribution, especially in slight cases, is a question of considerable importance in view of the conclusions arrived at by André-Thomas and Durupt from experimental work, which Thomas attempts to support by certain clinical observations. These authors have described as a result of small limited lesions of the cerebellum an affection of the tone of certain

muscles or groups of muscles only, so that a condition of *anisosthenia* or loss of tone in some muscles and relative hypertonicity of their antagonists, results. It is to this disturbance that André-Thomas attributes many of the symptoms of cerebellar lesions which occur in man.

Though I have carefully searched for this condition in the majority of my patients, I have been unable to find any support for his observations. In the early stages of extensive lesions the atonia is certainly uniform, no matter what method is relied upon for its demonstration; and even during recovery, as well as in cases of circumscribed injuries, I have been unable to discover that it is ever limited to certain muscles. In my notes of one case, it is true, it is recorded that on the twenty-seventh day "there is perhaps relative hypertonicity of the adductors and inward rotators of the shoulder, and of the supinators," but in both the earlier and later notes it is emphasized that the hypotonia was general and uniform in the affected limbs. If such anisosthenia existed commonly it would probably be most obvious in cases with local and restricted lesions of the cerebellum; but though I have seen many of these I could find no evidence of it.

The one common symptom that might be advanced in support of Thomas's thesis is the tendency to deviation of the unsupported limbs, and the frequent error in projection revealed by Bárány's pointing test; but these signs will be dealt with later.

In cases which remained under observation for some time the hypotonia diminished gradually and uniformly, but in all it persisted and was easily demonstrable till the patients were transferred to England. In three cases it was still pronounced seventy-one, seventy-eight, and ninety days respectively after the infliction of the wound. Even in the case in which the injury dated from eight years previously the homolateral arm and leg swung about more inertly, and the patient, who was an educated man, described them as "floppier" than his normal limbs.

(2) *Voluntary Movement.*

(*A*) *Strength.*—The flabby toneless limbs of the affected side give an unmistakable impression of feebleness when they are handled or examined, and many patients have spontaneously complained that they are "weaker" or "more useless," or that they "have not nearly so much power in them," as they formerly had, or as those of the opposite side still possess. This impression is, however, not wholly borne out by examination, for the degree of paresis is always moderate. But there can be no doubt that during the earlier stages of every extensive injury of one side of the cerebellum the strength of all the movements of the limbs of this side is definitely reduced, even when concomitant lesions of the cerebrum and of the chief motor paths can be excluded with certainty. Both the proximal and the distal muscles are affected and as a rule the former

appear on the whole relatively weaker. The feebleness is always more pronounced in the arm than in the leg.

This feebleness is usually obvious even when the patient attempts any movement that requires the exertion of power, since more effort is apparently necessary to perform it. This may be seen when he is asked to hold his arms horizontally outstretched or when he tries to raise an object of moderate weight, and the longer the attempt is prolonged the more striking is his difficulty.

When in such cases the strength of various movements, as grasping, flexion and extension of the elbow, flexion of the hip, etc., is tested and compared with that of the corresponding muscles of the opposite side, the difference is usually definite and is approximately proportional in all movements of one limb. This can be easily demonstrated by dynamometric readings. With Dr. Castex's dynamometric apparatus, which he kindly lent me, I obtained the following measurements of the maximal force of several movements of the two sides, in two cases of severe unilateral injury.

	Case 1 (thirty days)		Case 2 (seventeen days)	
	Unaffected side (R.)	Affected side (L.)	Unaffected side (L.)	Affected side (R.)
Grasp	12·4	5·8	17	10·7
Flexion of elbow ..	26·2	15·3	27·3	16
Extension of elbow ..	11·8	5·2	—	—
Supination	10	5·2	25	14·5
Pronation	20	14·5	31	25·5
Extension of ankle ..	17	15	—	—

In Case 1 there was a penetrating wound, from which a piece of shell casing was removed, over the middle of the left lobus gracilis; a considerable amount of softened cerebellar tissue escaped at the operation, and it is probable that the nucleus dentatus was involved. Healing occurred rapidly without any hernia formation.

In Case 2 a large fragment of metal entered over the lateral third of the right lobus gracilis and was removed from the mesial portion of this lateral lobe. There was considerable destruction of cerebellum and a hernia developed, but the patient eventually recovered.

These figures represent the average of several readings for each movement. Case 1 was examined on the thirtieth, Case 2 on the seventeenth day after the infliction of the wound.

The lower records on the affected side may be partly attributed to the difficulty and awkwardness of this hand in holding the instrument; this may be a factor especially when the power of grasping is tested by the ordinary dynamometer, but it can have little influence in estimating the power of other movements by Dr. Castex's apparatus.

When a series of records is made it is also found that the affected limbs tire more quickly than their fellows, and the power exerted by

the contracting muscles then diminishes considerably. It is often obvious too, that when the patient is asked to grasp the observer's hand as strongly as possible, the grasp of the affected limb is less continuous and less well maintained than of the other; but this is not always so. It can be even more easily demonstrated when the patient attempts to depress the observer's hand with his extended arm; the exertion of power can be felt to be jerky and more or less intermittent. In other movements, too, a similar irregularity in the exertion of power can be often detected, and if the lesion is severe the contraction of the muscles in every action against resistance may be less well maintained.

The sudden unexpected relaxations of contracting muscles that sometimes occur are closely allied to this; in standing, for instance, the leg of the affected side occasionally gives way under the patient, and some men complained that they were afraid to use the affected hand in taking food and in similar actions, as any object they grasp by it is liable to fall suddenly from it. But even when a limb is definitely weak in active movements its static strength—that is, the resistance it can offer to displacements which the patient attempts to resist voluntarily—is generally unaffected. If, for instance, he attempts to keep his elbows or his fingers flexed when the observer tries to extend them, the power necessary to overcome his resistance is approximately the same on the two sides.

Another feature, which is often very striking when the cerebellar injury is severe, is the apparent reluctance of the patient to move the affected arm. This may be frequently seen to lie for long periods in the same attitude, and though he may frequently bring the opposite hand to his face, arrange the bedclothes with it, etc., he more rarely employs the affected one. And when food or any object is offered to him it is almost always with the unaffected limb that he takes it. This may be partly due to the patient's knowledge that he cannot use the affected limb as efficiently or as safely as the other; but it is impossible to observe a patient with a recent cerebellar injury for any time without coming to the conclusion that there is an inherent reluctance to move the limb unless it is necessary. Even if his two hands are pricked by a pin the patient withdraws the affected limb less readily and less briskly than the normal. I could, however, never observe any difference between the reflex withdrawal of the limbs of the two sides from a noxious or painful stimulus. In two cases it was noticed that during the early stage of chloroform anæsthesia the patient in struggling moved only or chiefly his normal limbs.

Further, in the early stages of a cerebellar injury there is almost always a marked slowness of the movements of the affected limbs, and especially of the arm, as compared with that of the other side. If a rod is held in front of the patient equally distant from his two hands and he is asked to take hold of it with both, it is found that the movement starts

more slowly on the affected side, and that this limb seizes the rod an appreciable time after its fellow. Undoubtedly the slowness in reaching the object is partly due to the irregularity of voluntary movement which is generally known as "ataxia," but this is certainly not its only cause. This may be seen when the observer's hands are placed in the patient's, and he is asked to grasp them firmly at a given signal; the slowness of the affected limb in starting the action and in developing full power is often unmistakable. It matters not whether the patient attempts such simultaneous actions of the two limbs at the rate he chooses, or whether he is asked to do them as quickly as possible, the affected limb lags behind the other. In the early stages of severe injuries it is in fact difficult to make him hurry in movements of the affected limb.

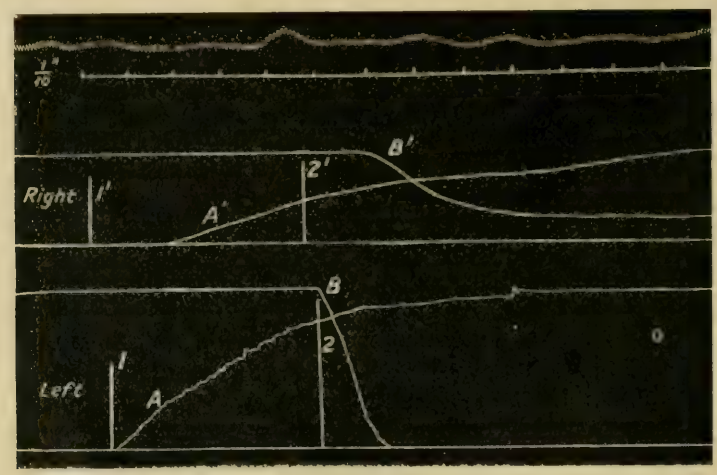

FIG. 3.—From a case of moderately severe injury to the right lateral lobe ten days after the infliction of the wound. The patient was asked to grasp simultaneously with his two hands against two equal springs. 1 and 1′ represent the simultaneous ordinates, A and A′ the lines traced on a rapidly revolving drum. The drum was allowed to complete one revolution and a signal to relax was then given; 2 and 2′ represent the simultaneous ordinates, and B and B′ the curves traced by the released springs. Time by a tuning-fork of 128 vibrations per second.

Even in cases of less severe injury in which there was no obvious loss of power, this slowness in movement is also apparent. It may be partly attributed to the fact that experience has taught the patient that the more rapidly he attempts to make a movement the less well can he control it; but that this is not the whole explanation can be easily seen by the investigation of simple movements, especially by the graphic method. Fig. 3 reproduces the tracings obtained when a patient with a right-sided lesion was asked to grasp simultaneously on a given signal against two carefully graded and equal steel balance springs. With his left hand, A, he started immediately on the signal being given (1 and 1′) and attained full power

in about five-tenths of a second; but in his right hand, A′, there was a delay of two-tenths of a second in starting the contraction, and the exertion of power did not attain its maximum till one second later. Further, the power exerted was little more than one-half that developed by the left hand.

When the signal to relax was given (2 and 2′), his left hand opened at once and the tracing, B, quickly reached the base line, but on the right side relaxation did not commence till about one-seventh of a second later, and the fall of the tracing to the base line was much more gradual even though the extension of the fingers was aided by the tension of the extended spring. The same features may be seen in the tracing reproduced in fig. 4; here the right hand, which was affected, was less slow in

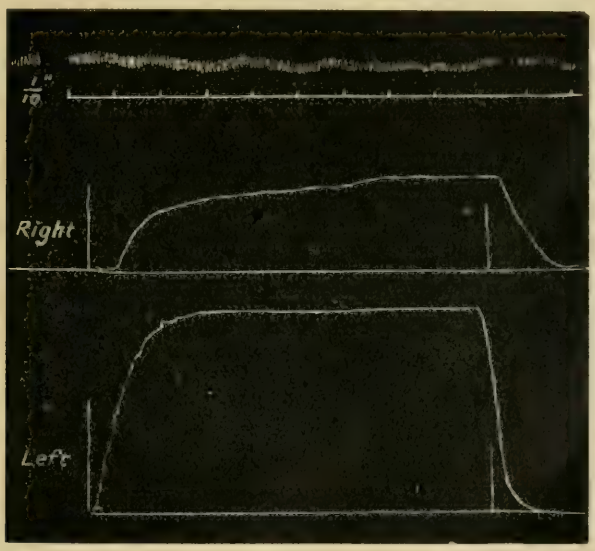

Fig. 4.—Tracings of simultaneous grasps obtained as in fig. 3. From a case of right-sided injury fourteen days after the infliction of the wound. Legends as in fig. 3.

initiating contraction, but the full power of grasp was only attained after six-tenths of a second, and its strength was only half that of the left hand. There was also an appreciable delay in commencing relaxation and a definite slowness in its completion.

In fig. 5 the same condition is seen when a third patient with a right-sided lesion attempted to flex his elbows simultaneously against resistance, and later relax on a given signal; in this case delay in initiating, and slowness in effecting, relaxation were the most prominent features.

The same facts may be easily observed in other movements of the

affected limbs in the majority of, if not in all, patients with severe and moderate unilateral injuries. When, however, corresponding muscles of the two limbs are stimulated simultaneously by a faradic current no slowness in either their contractions or relaxations can be detected (fig. 6);

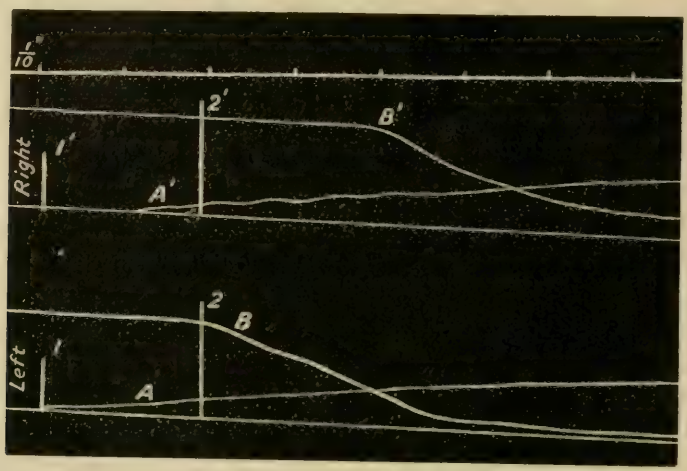

FIG. 5.—From a case of injury of the right lateral lobe and probably also of the vermis of the cerebellum, six weeks after the infliction of the wound. Tracings, A and A', of an attempt to flex his two elbows simultaneously against the resistance of two equal springs, and later to relax them simultaneously on a given signal B and B'. 1 and 1' and 2 and 2' represent the simultaneous ordinates.

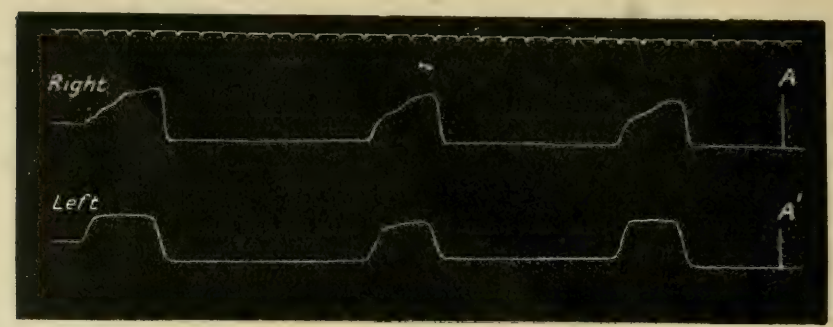

FIG. 6.—Tracings obtained from tambours placed on the tendons of the flexors of the fingers of the right and left hands when these were stimulated simultaneously by a faradic current, in a patient with an extensive right-sided cerebellar injury. There was in this patient a considerable delay in the initiation of both voluntary contraction and relaxation of these muscles. A and A' represent the corresponding ordinates. Time in fifths of a second. Read from left to right.

nor is there any difference in the latent periods of their contractions when these are excited reflexly.

We consequently find that (1) a delay in initiating muscular contractions; (2) a slowness in attaining the exertion of full power; (3) a delay

in commencing relaxation; and (4) a slowness in effecting relaxation, are among the symptoms produced by cerebellar lesions. As a rule, there is delay and slowness in both contraction and relaxation, but occasionally only contraction, or more commonly relaxation, is slower than it is in the normal limb; a slowness in relaxation is probably the most common.

The affected limb also tires more rapidly than the normal, especially in movements that demand power and in those made against resistance.

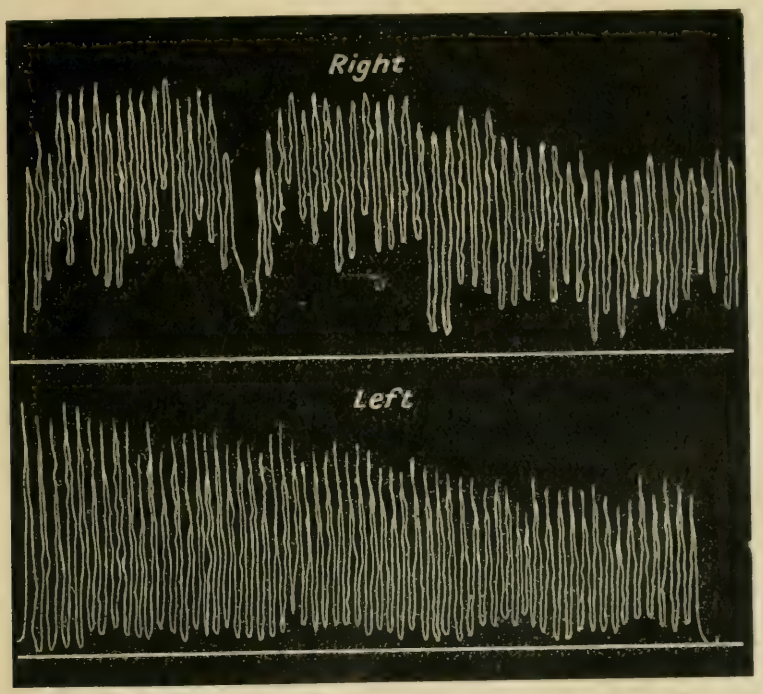

FIG. 7.—From a case with an extensive right-sided lesion five weeks after the onset. The patient was asked to compress and release a strong spring as quickly as he could with his left and his right hands in succession; the movements of the spring were recorded in a slowly revolving drum. The tracing obtained from the left hand shows only evidence of fatigue; that from the right hand is very irregular and frequently did not reach the abscissa, owing to the patient commencing to flex his fingers again before he had fully relaxed his grasp.

This can be well seen if the patient is made to hold his arms outstretched horizontally in front of him, or to keep his legs elevated from the bed. At first the affected limb is usually held very steadily, but it tires rapidly, and then a coarse jerky tremor often appears, owing chiefly to his voluntary attempts to regain the position from which the tired limb gradually falls away. The tendency of the affected limbs to tire more rapidly can be seen in most ergographic tracings. In these the range of movement is also generally smaller and more irregular,

while its rate is slower. Occasionally, however, as in fig. 7, the most striking feature is due to the fact that when the patient attempted to perform such movements against resistance as quickly as he could a second contraction often occurs before the previous relaxation was complete, and consequently in many excursions the tracing did not reach the base line. In this patient there was an obvious delay and slowness in starting and in completing the relaxation of contracting muscles.

The weakness of the limbs of the affected side is always most evident in the early stages of the cerebellar injury and diminishes gradually. In several of the cases in which the lesion was small or moderate in size no difference could be detected in the power of the homologous limbs after two to three weeks, but in more severe injuries the paresis is more persistent. In the two cases referred to above in which dynamometric readings were made, it was still obvious in each upper limb eighty and seventy days respectively after the infliction of the wound, but the lower limbs were then equally strong. Even when their strength had recovered the affected limbs still remained appreciably slower in movement than the normal.

This form of weakness due to cerebellar wounds is distinguished from that produced by lesions of the cortical motor area or of the cortico-spinal tracts by its homolaterality, by its uniformity and the approximately equal affection of all groups of muscles, by the fact that though all voluntary movements are weak none are limited in range, by the absence of the characteristic alterations in the reflexes, and by the fact that there is no tendency for rigidity or contractures to develop. The term *asthenia* introduced by Luciani is consequently more suitable for it than paresis.

(*B*) *Ataxia.*—But the most obvious sign of cerebellar disease is that irregularity in voluntary movement which is generally loosely described under the term "ataxia," though physiologists and certain clinicians have tried to analyse it into simpler components.

This disturbance of voluntary movement may be most easily studied separately, as it occurs in the early and in the later stages of extensive lesions, since in the latter period the effects of cerebellar deficiency are complicated by the results of "compensation" by other parts of the nervous system, and by the voluntary efforts by which the patient attempts to control his disability.

In the early stages all movements of the limbs are affected, but the disturbance is more striking in the upper than in the lower extremity, and in complex than in simple movements. It must be emphasized that the control of movements by vision has no influence on their regularity, and that they are quite as "ataxic" when the patient's eyes are open as when they are closed.

Let us assume we have a patient with a recent severe lesion of the right half of his cerebellum. When he is asked to touch an object with his left forefinger he does so promptly and accurately, and to reach it moves his hand in the most direct line practicable from the position in which it lay. He raises his right hand from the bed less promptly, and as soon as the limb is unsupported it sways unnecessarily and aimlessly at its more proximal joints, and during the movement his finger deviates from the direct course by which it could most easily reach its aim. Further, he rarely succeeds in touching the object at once, but usually brings his index to one or other side of it, and projects it too far or more rarely stops the movement too soon. Errors consequently occur in both the direction and in the range of its movement. If his elbow is fixed so that it is necessary for him to move only his forearm and hand, the irregularity and inaccuracy of the movement is less pronounced. Similarly, if when his arm is extended vertically or held outstretched in front of him, he is asked to bring his index finger to his nose, it is seen that his finger does not take the direct and shortest course, and instead of coming accurately to his nose it often strikes his chest, chin or forehead. Further, it is often brought to his face with undue force.

If an attempt is made to obtain from the patient his explanation of this irregularity of his movements he merely describes, if he happens to be intelligent, that which the observer has already noticed. One patient said: "I don't seem to have the power to do what I want to with my hand, though if I take hold of anything with it I can grip it all right. If I want to bring it to my mouth I only hit my eye with it; it is drunk; it won't go straight." Another man described his disability by the statement: "I don't feel that I can get the right direction with this arm"; while a third patient when examined in a later stage (ten weeks after the infliction of the injury) complained that he "could not pull the arm up quickly enough," and therefore brought his finger beyond any point he wished to touch.

This irregularity in direction and range is always more marked in rapid than in slow movements; in fact when the patient is asked to execute the movement slowly, or is urged not to hurry, there may be little or no obvious disturbance. Further, simple actions which require movement at one joint only may be fairly accurately performed, though complex actions are irregular and ataxic; the patient can succeed much better in touching with either his finger or toe an object that he can reach with the limb extended than when movements at the elbow, knee or other joints are also necessary.

The movements of all segments of the limbs are generally affected, and those of the distal joints are in fact usually the most seriously disturbed. If, when the patient's eyes are closed, an unknown object is placed in his

hands and he is asked to identify it, it may be seen that he handles it and moves his fingers over it irregularly and awkwardly; often he only grasps it firmly and rubs it between his finger and thumb. The affection of his fingers is better demonstrated and more easily analysed if he is asked to bring the tip of each finger in succession to the top of his thumb; then he frequently fails to place finger and thumb in correct apposition, the finger often slides along the side of his thumb, and the relative degree of movement at the different joints of the finger are not so regular or appropriate as in the normal hand; sometimes only the metacarpo-phalangeal joint is flexed, or the bending of the interphalangeal joints may be excessive. The rate of movement, too, is not uniform, but is often jerky and intermittent. Further, while in the normal hand each finger is flexed separately, on the affected side all fingers are frequently flexed at the same time, though he wishes to bring one finger only to his thumb.

When this disturbance of movement is more carefully examined several factors can be distinguished in it. These may be most easily considered separately, though the relative prominence of each may vary in different cases and even in different stages of the one case.

(i) *Decomposition of Movement.*—If we again ask the patient as he lies in bed to extend his arm vertically over his face and then bring his fore-finger to his nose, it is seen that instead of depressing his arm and flexing his elbow simultaneously, he first brings his elbow towards the bed and only when it is there or near it does he approach his finger to his nose by flexing his elbow. In other words, he "decomposes" the movement into its separate elements (Babinski). This may be seen in various other actions of both the upper and lower limbs. One patient, for instance, when asked to place the heel of his affected side on his opposite knee always dragged the heel along the bed till it reached the knee and then only raised it to the proper height; other patients on the contrary have raised the heel unnecessarily before beginning to flex the knee. Or if the patient be asked, as he lies on his back, to bring his heel to his buttock, he may do it in two stages: first flexing his hip and only later flexing his knee. Similarly, if when able to leave bed he attempts to place his foot on a chair, he frequently raises the foot too high by flexion of his hip before he bends his knee.

In other words, the patient tends to perform the separate movements that constitute an act "by numbers," as in a gymnasium or in military drill. This is the condition which Babinski has termed *asynergia*; he has defined it as "the inability to accomplish simultaneously the various movements that constitute an act."

The question arises whether this decomposition of movement is voluntary or not. I know of no test that can settle this point directly, but the fact that it may be observed in its extremest form when the

patient, still in a dull and stupid state on recovering from the early general effects of a wound, or after an operation which has entailed further damage of the cerebellum, first makes purposive movements, suggests strongly that it is not always a willed device by which he attempts to diminish the inaccuracy of his limbs.

(ii) *Asynergia.*—The term asynergia can be more correctly restricted to the absence or disturbance of that proper synergic association in the contraction of agonists, antagonists and fixating muscles, which assures that the different components of an act follow in proper sequence, at the proper moment and are of the proper degree, so that the act is executed accurately and with the least possible expenditure of energy.

When the fingers are flexed the extensors of the wrist normally contract synergically with appropriate force in order to prevent simultaneous flexion of the wrist, but when a patient with a cerebellar lesion grasps a small object quickly it often happens that the wrist of the affected side is extended excessively or too early, so that the hand is bent backwards when the fingers are but half flexed: the normal co-operation of the contracting muscles, on which the accuracy and precision of the action depends, is consequently disturbed. This can be often seen more definitely when the patient flexes and extends his fingers rapidly; then the wrist often flexes as he brings his fingers into his palm, or extends too much as he straightens them, or the finger movements and the synergic wrist movements may be partly dissociated or inaccurately combined in time or in degree.

A disturbance of synergia, which should keep the legs extended and thus bring the centre of gravity of the body as near the pelvis as possible, is also the explanation of the fact that in attempting to rise from the supine position by flexion of the trunk upon the hips the heel of the affected side often rises from the bed (Babinski). Frequently, however, only the knee is raised by flexion of the hip on the trunk and the heel remains in the bed owing to failure of the normally associated contraction of the quadriceps extensor. Babinski has also shown that the cerebellar patient, when standing, often falls when he throws his head backwards, owing to his failure to bring his centre of gravity over his base by flexing his knees, and I have observed this in several cases. When asked to sit down on a low bed or stool he is also liable to fall backwards, as he again fails to adjust his balance by flexing his trunk on his hips. Other examples are seen in walking, as the affected arm generally hangs inertly by his side and does not swing forwards when he advances his opposite foot; and in the failure of his head and eyes to move simultaneously when he looks to one or the other side.

In the majority of such movements the contracting muscles (agonists) have to displace the limb or some of its segments against gravity, and

their antagonists only relax reciprocally; but in other actions, as when the elbow is fixed above his head and the patient brings his finger down to his nose, that is in the direction in which its weight would move it, the most important factor is the gradual relaxation of muscles which are the antagonists of the flexors of the elbow. The disturbance in the co-ordinated activity of agonists and antagonists suggested comparison of movements executed with and those performed against gravity, but though this was investigated in certain cases, as by making the patient bring his finger successively up to and down to his nose by merely bending his elbow, no significant difference could be detected.

(iii) *Dysmetria.*—Another striking abnormality in the affected limbs is the fact that the range and the force of their movements are not correctly adapted or proportioned to their aim; they are ill-measured or dysmetric (Luciani). In attempting to touch a point, for instance, the finger-tip often shoots past it, or more rarely the movement is arrested before it reaches it. And in bringing his finger to his nose, the patient may either strike his face too forcibly, or arrest the movement momentarily before he reaches it. Similarly, when asked to grasp an object, he throws his arm forward with excessive force, opens his hand unnecessarily widely, and finally seizes it too roughly and too forcibly. In other words, neither the range nor the force of the movement is accurately adapted to its aim.

This is particularly prominent in quick movements; when the movement is slow, and can be closely watched by the patient, it is more correctly graded, but even in slow and deliberate actions, as in carrying out Bárány's pointing test, dysmetria may be seen. Often, too, as he makes a deliberate attempt to touch his nose, he allows his affected hand to flop heavily against his face, as though he were too lazy or careless to pull it up.

It is noteworthy that as has been pointed out by other observers (Babinski, André-Thomas), the range of movement is most commonly excessive, but in the early stages of acute cerebellar lesions it happens frequently that the movement is arrested or slowed down before the point the patient wishes to attain is reached, and the hand or foot is then brought to it by a series of slow deliberate jerks. In a few cases the most striking abnormality when the patient tried to take hold of an object was the tendency of the affected hand to stop short of it, pause for a moment, and then swoop down on it with excessive force. In other actions, too, as when he tries to bring the tips of his fingers successively to the top of his thumb, the range of movement is often too small rather than excessive.

This dysmetria is particularly pronounced in the attempts to perform accurate movements against resistance, as when he tries to raise a moderate weight, or to release his finger from the observer's grasp and bring it directly to the tip of his nose. It is under such conditions that

the difficulty in arresting a movement that was correctly initiated is most obvious. These facts suggest that dysmetria bears a close relation to the symptoms described under the "rebound phenomena."

(iv) *Tremor.*—Voluntary movement is also often complicated and disturbed by the occurrence of tremor in the moving limb, but this is not such a prominent factor in the early as it is in the later stages of a cerebellar lesion. In the notes on many of my more serious cases it is stated definitely that there was no tremor.

Frequently, however, and especially in quick movements, the finger or toe is approached at a fairly uniform rate to within a few inches of the point the patient wishes to touch, and is thence brought to it by a series of irregular brusque jerks, which to some degree resemble those of ordinary intention-tremor, though the pauses and interruptions of movement are usually less abrupt, and the projections more deliberate and larger in range. And even when the limb reaches the object for a time it is not held steadily in contact with it; after the patient has brought his finger to his nose, for instance, the tip of the latter is often intermittently depressed or displaced to one side or the other.

The coarser forms of tremor may be associated with dysmetria, the movement being arrested too soon, and the limb then approached to the object by a series of jerks; or it may be due to voluntary arrest of the primary movement and the subsequent attempts of the ataxic limb to reach its aim. It cannot be attributed wholly to these causes. When simple movements, as flexion or extension of the forearm or leg, are carefully observed, it may be often seen that the limb is moved in a series of irregular jerks, and that the tremulousness usually increases towards its completion when accuracy is most essential. It is occasionally possible by palpation of the muscles to detect an irregularity or discontinuity in their contractions. Occasionally, however, the movement seems to be interrupted by irregular intervention of the antagonists. Consequently, even from its commencement the movement is often irregular, and throughout its whole range it lacks the continuity and uniformity in rate which distinguish ordinary voluntary displacements of a limb.

(v) *Deviations from the line of movement.*—It has been already stated that the irregularity of movement in the early stages of a cerebellar lesion are partly due to the fact that the limb deviates from the direct line, and is not moved along the shortest course that it should naturally take; but this symptom needs more emphasis, as it has been overlooked by many clinicians who have studied chiefly the later effects of cerebellar injuries, or the symptoms of atrophic or degenerative diseases of this organ.

This deviation in movement was observed by Grainger Stewart and myself after the removal of tumours and surgical damage of the cerebellum, and I have seen it frequently since in similar cases. It is equally obvious

in recent gunshot injuries. In the early part of the movement the limb sways about in a purposeless manner as soon as it is raised from its support; during the movement it deviates from its proper course, and towards its completion it does not come straight to the object it should touch or seize; in trying to touch his nose, his finger, for instance, often comes to his cheek or eye. One patient declared that when he attempted to feed himself with the affected hand it was frequently to his ear that he brought the food, and another that he could not use this hand in smoking, as he was afraid of putting the cigarette into his eye. This error cannot be attributed to dysmetria, or to properly directed movements executed with ill-graded force, as the hand which the patient wishes to bring to his nose often comes to his cheek or eye even when it is moved from directly in front of his face.

The slow swaying at the commencement of the movement is most pronounced when the limb is atonic, and it seems to be directly associated with loss of tone in the muscles that should fix its proximal joints; it often suggests an asthenic or paretic condition. But the deviation from the direct course during the movement and the failure to bring his hand or foot to the correct point, must be attributed to disturbance in the regulation of the force and sequence of the contractions of the different muscles employed in the act. Decomposition of a movement naturally produces errors in its direction, and a similar disturbance in the co-operation of the various muscles, even though it does not cause obvious decomposition may lead to deviations from the correct direction.

It is an interesting point whether there is any constancy in the direction in which the limb deviates during and at the completion of the movement, and if so what its relation is to the direction in which it tends to deviate when unsupported and in Bárány's pointing test. No regularity in the direction of the deviation can, however, be observed in early cases, though later the frequent tendency to spontaneous deviation often influences the direction of the error. One man, twenty months after the infliction of a cerebellar wound but who now presented symptoms of disseminated sclerosis as well, in attempting to touch his nose when his eyes were closed always brought his forefinger to that side of it towards which his arm tended to deviate in Bárány's test, and the same fact was observed in another patient three months after he had been wounded. It is in such cases that Babinski rightly contrasts the failure of the cerebellar patient with that of the tabetic in attaining his aim.

After the first few weeks, according to the nature and the severity of the wound, these disturbances of voluntary movement begin to alter in character. When the patient raises his arm or leg the limb sways about less aimlessly, in movement its deviations from the correct direction are less obvious, and it generally reaches its aim more directly.

At the same time the tendency to decompose or "two-stage" movements is less common in simple actions, as in bringing his finger to his nose, though it can still be detected in more complex actions. The disturbances in the co-ordination of agonists, antagonists and synergic muscles also diminish; in closing his fingers quickly there is less tendency to over-extension or to flexion of the wrist, and the wrist and finger movements are more correctly associated when he rapidly extends or flexes the latter.

On the other hand, the deficient regulation of the range and force of movements, which has been described as dysmetria, persists or may be even more striking now. The arm is flung out from the shoulder and the hand tends to grasp every object with too much force. At this stage the range of movements is much more frequently excessive than short of its aim; dysmetria therefore generally takes the form of hypermetria. Movements consequently tend to be performed too abruptly and too forcibly, though they still start more slowly than those of the normal limb.

Now, however, voluntary correction begins to play a greater part; when the patient's movements and actions are carefully watched it may easily be seen that he tries to correct his errors. If on one occasion he overshoots his mark, in subsequent attempts he may stop short of it. The patient who stated that he could not pull up the affected arm quickly enough now began to arrest his finger short of his nose when he attempted to touch it, and then brought it in contact with it by a series of deliberate coarse jerks; and if the arm at first tended to strike his cheek or eye when the patient tried to bring his finger to his nose he now stops before he reaches his face and completes the action in the same intermittent, jerky fashion.

An irregularity in movement resembling intention-tremor is consequently a prominent feature at this stage. This cannot however be attributed wholly to the intervention of voluntary effort in order to control the errors, as even the jerks are irregular and inappropriate in range and force, though it is usually more pronounced the more rapidly the movement is performed and consequently the less opportunity the patient has to correct his errors voluntarily.

But in order to understand more fully these disturbances of voluntary movement it is necessary to investigate the symptoms included here in the rebound phenomenon, and to observe the affected limbs as the patient attempts to perform alternate movements rapidly with them.

(*To be continued.*)

RESULTS OBTAINED FROM THE USE OF ANTI-DYSENTERIC SERO-VACCINE IN THE FIELD, WITH REGARD TO THE REDUCTION OF CASE INCIDENCE.

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In a paper published in the Journal of the Royal Army Medical Corps, June, 1917, dealing with the experimental work on, and the preparation of this vaccine, I stated that a trial of the vaccine under war conditions was contemplated. War Office sanction was obtained and the tests have now been carried out with encouraging results.

A test was arranged for in two spheres of operations and in each case the incidence of bacillary dysentery was diminished among the men inoculated with the vaccine.

From the fact that the inoculated and uninoculated men were men of the same battalions and even of the same platoons and so were exposed to exactly the same risk of infection, the reduction of the case incidence among the inoculated individuals is satisfactory and points to the value of this prophylactic measure.

The vaccine used was prepared by the same methods as described in the first paper [1] as far as the principles of the vaccine are concerned. There were some slight differences in the technique of the preparation which was in its earliest infancy when the former paper was written and has been improved upon since.

Two tests were arranged; one in the Near East, and a second on the Western Front.

Dealing with the test in the Near East first, while the total incidence of dysentery was not high, that occuring among the inoculated men was markedly less than that among the uninoculated. At the same time an exact mathematical comparison between the two groups of men, that is between the inoculated and uninoculated, is unfortunately not possible, as the experiment was not fully controlled. The following is the reason for this:—

To control effectively the results of inoculation it was necessary to take the uninoculated men in the test units and to observe the amount of dysentery among them over the same period as that among the inoculated men. The only efficient method of doing this was to take a nominal roll of the uninoculated men present with the units at the time that the inoculations were completed and to follow these men only over the observed period. This was not done and the only information I could obtain was the average number of inoculated men and the average number of uninoculated men present with the units for a period of eighteen weeks after inoculation had been completed. Now there is a certain amount of

wastage due to other causes than dysentery, and while there were no further inoculations done, which resulted in the strength of the inoculated men assuming a steady downward curve, the other side, i.e., the controls, were reinforced from time to time with fresh drafts and thus there were more men than are shown by the average strength who had been exposed to infection.

However, against this may be put the fact that while the inoculated men were exposed to infection over the whole period of eighteen weeks, owing to the wastage and reinforcement the uninoculated men, although there were more men present with the units than the figures indicate, individually were exposed to infection for a shorter time than the inoculated men. On this account although the results are not so accurate as they might otherwise have been they seem worth publishing in the meantime until others can be collected, which cannot be done until the return of the hot weather.

In this locality there have been every year two rises in the curve of the dysentery incidence among the troops :—

(*a*) That making its appearance at the commencement of the hot weather, and

(*b*) That which takes place in the autumn.

The men inoculated were given their two doses of the sero-vaccine (in one unit fifty-two per cent of the total strength were given two doses, and nineteen per cent of the total strength three doses) towards the end of the first rise in the curve. As it happened the autumn rise was not very well marked and was much lower than during the previous year.

The figures are too small to form a definite opinion on, but to my mind they certainly are encouraging. The officer in charge of the laboratory that dealt with the greater portion of the cases of dysentery which arose in these three test units gives his opinion in a report as follows :—

" The number of cases dealt with has been too small from which to draw safe conclusions, but it would appear that the inoculation has conferred a considerable measure of protection against bacterial dysenteric infection."

In the three original test units the observed population at the time the inoculations took place was 2,700 men. Of these, 1,150 were inoculated and 1,550 were left uninoculated and served as controls. Observations were carried out over a period of eighteen weeks.

None of the inoculations caused any ill effects. In the majority of cases there was a general reaction noted which, as a rule, made its appearance on the same day as the inoculation took place and had passed off by the next day. The local reactions were, as a rule, quite mild and had passed off in forty-eight hours. The medical officer in charge of one of the units reported, " arm in nearly all cases fit for use in thirty-six hours."

Among the inoculated men there occurred nine cases of dysentery; of

these seven were diagnosed on clinical grounds and the infecting organism was recovered from two. One of these two men developed dysentery due to *Bacillus dysenteriæ* Flexner five days after his second dose of vaccine, a time when, as I shall show later on in the paper, there seems reason to suspect very little immunity has yet been acquired. In the other case the infection was due to *B. dysenteriæ* Shiga, and in this case the patient at the time of his admission to hospital did not show any agglutinin in his blood to the specific organism.

In addition there were two more cases of bacillary dysentery in men who had only received one dose of vaccine. One of these cases was due to *B. dysenteriæ* Shiga and one to *B. dysenteriæ* Flexner. As throughout the experimental work it has been impossible to demonstrate any protection against the disease after one dose of vaccine these two cases have been excluded from the returns under inoculated men.

At the same time they have not been added to the total number of cases among the uninoculated men, to which they probably should be added. The men returned as inoculated are only those who received two, or in some cases three, doses of vaccine.

During the same period of eighteen weeks there were sixty-six cases of bacillary dysentery among the uninoculated men of these three units. Of these fifty were diagnosed on clinical grounds and the infecting organism was recovered from sixteen.

The following table shows the number of cases among the inoculated and uninoculated men in the test units :—

TABLE I.

Unit	Uninoculated					Inoculated				
	Average strength	Bac.	Clin.	Total	Case incidence per cent	Average strength	Bac.	Clin.	Total	Case incidence per cent
A ..	406	4	27	31	7·6	285	1	6	7	2·4
B ..	437	2	14	16	3·4	386	—	1	1	0·2
C ..	630	10	9	19	3·0	232	1	—	1	0·4

Bac. = Cases in which the infecting organism was isolated.
Clin. = Cases diagnosed clinically, i.e., diarrhœa with blood and mucus in the stools.

Among the inoculated men there was no evidence of any negative phase as during the first fortnight after the inoculations were completed, and during which time the effects of wastage had not come into play, there were thirteen cases of dysentery among the uninoculated men (1,550) and only one case among the inoculated (1,150) and this was the man who developed the disease five days after his second dose.

At the same time it is interesting to note in view of the table of inoculation agglutinins that of the 9 cases of dysentery which occurred

among the inoculated 7 were contracted within four weeks of inoculation while after that time only 2 men contracted the disease over the remaining period of fourteen weeks that they were under observation.

The fact that a man has been inoculated does not seem to have any effect on the isolation of the infecting organism from his stools should he afterwards develop dysentery, as in the case of the inoculated men who subsequently developed dysentery the infecting organism was isolated from 22·2 per cent, and from the uninoculated men in 24·2 per cent of the cases.

The following table gives the results of inoculation in a base camp in France. The observations were carried out over a period of nine weeks. In this instance a nominal roll was made of the inoculated men and also of the control men who were present and uninoculated. There were 975 men inoculated and 1,361 men were taken as uninoculated controls and followed up through the nine weeks.

During that time there were four cases of dysentery among the inoculated men. Of these one was diagnosed by the isolation of the infecting organism and three on clinical grounds. Among the uninoculated there were 14 cases, of which 7 were diagnosed clinically and 7 by isolation of the bacillus causing the disease.

The case incidence among the inoculated per thousand per week for the period of the nine weeks was 0·46 and that for the uninoculated 1·13, giving a ratio of 1 to 2·45 in favour of the inoculated men. Here again the results obtained, though the figures are far too small to be of any great value, suggest that further trials might lead to even more encouraging results.

TABLE II.

Uninoculated					Inoculated				
Strength	Bac.	Clin.	Total	Case incidence per 1,000 per week	Strength	Bac.	Clin.	Total	Case incidence per 1,000 per week
1,361	7	7	14	1·13	975	1	3	4	0·46

Bac. = Cases diagnosed by isolation of the bacillus.
Clin. = Cases diagnosed clinically.

Table III shows the agglutination titres of the serum of inoculated men taken at intervals after inoculation; these figures refer to serum of men inoculated in the Near East and are estimated at intervals varying from seven days after the first dose, that is, on the day the second dose was given, to ten weeks after the second dose.

The inoculation titres correspond very closely to those observed by me in this country and published in the JOURNAL OF THE ROYAL ARMY MEDICAL CORPS in June, 1917, with the exception of those with *B. dysenteriæ* "Y" antigen. While the observed titres with this antigen were generally low and results very irregular in this table, I found that the serum of men

inoculated in England gave a higher titre with this bacillus than with the other two types *B. dysenteriæ* Shiga and *B. dysenteriæ* Flexner. I am inclined to think that this inconsistency is due to the different antigens employed in the estimation of the agglutinin content of the serum and not to the lower content of the serum itself.

It will be noticed in the table that there is no demonstrable agglutinin in the serum after the first dose of vaccine when tested with *B. Shiga* antigen, and very little with *B. dysenteriæ* Flexner and *B. dysenteriæ* "Y" antigens. It is not until three weeks after the second dose that the agglutinins in the serum seem to reach their highest point, and as the titres taken at the end of ten weeks are as good if not better than those at the end of three weeks, the point of the curve is probably reached at some period between the two dates.

TABLE III.

	Nil	1 : 50	1 : 75	1 : 100	1 : 150	1 : 200	1 : 300	1 : 400	Number of men tested
				Seven Days after First Dose.					
Shiga ..	100·0	..	..	..	..	..	..	..	6
Flexner ..	23·3	66·6	..	..	..	..	..	..	
"Y" ..	83·3	16·6	..	..	..	..	..	..	
				Seven Days after Second Dose.					
Shiga ..	75·0	6·2	6·2	6·2	6·2	..	..	..	16
Flexner ..	..	25·0	18·7	50·0	6·2	..	..	..	
"Y" ..	56·2	43·7	..	..	..	..	..	..	
				Three Weeks after Second Dose.					
Shiga ..	40·0	16·0	..	..	32·0	12·0	..	..	25
Flexner ..	20·0	..	28·0	..	32·0	20·0	..	..	
"Y" ..	72·0	..	16·0	..	4·0	8·0	..	..	
				Ten Weeks after Second Dose.					
Shiga ..	27·7	33·3	16·0	5·5	11·1	6·3	..	..	36
Flexner ..	3·3	23·3	23·3	3·3	23·3	13·3	10·0	..	
"Y" ..	55·5	13·9	11·1	2·7	13·9	2·7	..	..	
				Seven Days after Third Dose of Vaccine.					
Shiga ..	14·3	42·9	..	42·9	..	..	..	..	7
Flexner ..	..	14·3	..	14·3	14.3	28·5	14·3	14·3	
"Y" ..	28·5	71·4	..	..	..	..	..	..	

The figures represent percentages of the total numbers tested.

The groups do not represent the same batches of men, and the bottom group represents the sera of men who received three doses of the vaccine.

This apparently means that while there is no actual negative phase there is a marked latent period before the body responds to the stimulus of this vaccine to its full extent.

It is with regard to this fact that I mentioned that seven out of the nine cases of dysentery that occurred among the inoculated men in the Near East developed the disease within four weeks after inoculation while

only two cases occurred during the remaining fourteen weeks of the observed period.

At the end of twenty weeks all traces of inoculation agglutinins had disappeared from the blood in the majority of cases, though I have found agglutinin present in the serum of an inoculated man six months after his second dose. As a rule, however, after the end of four months they soon begin to be lost, lasting a somewhat similar time to the inoculation agglutinins after cholera vaccine has been injected into man.

Three doses of the vaccine seem to produce a higher agglutinin content than two, as one would expect to be the case. In practice it is generally impossible to give large bodies of men more than two doses of a vaccine.

From the agglutination table it will be seen that it is more difficult to produce agglutinins for the dysentery group of bacilli than for the other intestinal organisms. This I think may well be expected when one remembers how many cases of dysentery due to *B. dysenteriæ* Shiga fail to agglutinate the specific organism with their serum except in very low dilutions.

Castellani [2] also mentions the low agglutination titre obtained after inoculation with a mixed dysentery vaccine consisting of emulsions of twenty-four hour agar cultures in normal saline. These titres are very low, but in his case he only gave 62·5 million bacilli of each type for the first and second doses as compared with 500 million of each type for the first dose and 1,000 million of each type for the second dose which was given in the present series of men inoculated with the sero-vaccine.

The following is a quotation from Castellani's paper:—

"The reaction is not very severe though more marked as a general rule than after the typhoid-paratyphoid vaccine. Agglutinins generally develop for all the germs of the dysentery group which have been injected, but their amount is not high, the agglutination limit seldom being higher than 1 in 40, and is somewhat inconstant and irregular; but the same may be said of individuals inoculated with simple mono-vaccines Shiga-Kruse, Flexner, etc."

This irregularity is also seen in the case of dysentery convalescents. In a series of agglutination tests carried out by Ledingham and Penfold [3] on the sera of 103 convalescents, the majority of whom gave a history of dysentery, we find a varying agglutination content ranging from *no* agglutination in a dilution of 1 in 50 to one in a dilution of 1 in 800 when tested with *B. dysenteriæ* Shiga antigen. In this series the time after the onset of the disease is not stated but it is probably some weeks or a month or two.

Kennedy and Rosewarne give the agglutination titres of five of their cases [4]. These were all instances of carriers of either *B. dysenteriæ* Shiga or *B. dysenteriæ* "Y." Of the Shiga cases only one gave a positive reaction and the titre in this case was only complete in 1 in 15 and partial in 1 in 40; the tests being carried out seven months after the onset

of the disease. The two "Y" cases tested about four months after the onset of the disease gave complete positive results, one in a dilution of 1 in 500 and one in a dilution of 1 in 80.

All this may be regarded as an indication that it is a more difficult problem to confer immunity against this group of diseases than against diseases of the enteric group, since I have constantly found that unless there was some agglutinin present in the animal's or man's blood there was very little other evidence, direct or indirect, of protection.

The following instances all show this point:—

In my original paper [1] rabbit No. 17 in Table II was the only rabbit of the series whose serum failed to show any agglutination at the time the test dose of *B. dysenteriæ* Shiga was given. This rabbit was also the only one that did not show protection against the dose, with the exception of rabbit No. 21 which was not considered to have died from the effects of the injection.

Again, in the case of H. G. (Part II of the paper), when inoculated with vaccine mixed with unabsorbed serum, his serum showed neither the presence of agglutinins nor bactericidins, and failed to protect a rabbit against $2\frac{1}{2}$ M.L.Ds. of Shiga toxin. When, after the lapse of four months, this individual was inoculated again with the vaccine mixed with absorbed serum not only did his serum agglutinate *B. dysenteriæ* Shiga in a dilution of 1 in 150, but 0·5 cubic centimetre of his serum protected a rabbit against 5 M.L.Ds. of toxin (Part IV of the paper).

Also in this paper I mentioned that the man who developed dysentery due to *B. dysenteriæ* Shiga infection after he had been inoculated, failed to show the presence of any inoculation agglutinins in his blood at the time he contracted the disease.

The constant recurrence of this fact is interesting, and as far as it goes seems to indicate that the presence of agglutinins in the serum of inoculated individuals is an essential addit to a lasting immunity.

The following experiment, originally undertaken with a view of estimating the difference between the formation of opsonins and the immune body, as shown by the presence of the complement fixing proportion of the serum of men inoculated with the vaccine when mixed with absorbed and unabsorbed serum, also demonstrates in the case of opsonin formation the slow rise of the opsonin curve as compared with that seen in the case of other antigens.

Three men were inoculated with dysentery vaccine mixed with anti-dysenteric serum. In each case the dose of vaccine consisted of 500 million *B. dysenteriæ* Shiga, 500 million *B. dysenteriæ* Flexner, and 500 million *B. dysenteriæ* "Y" mixed with 0·8 cubic centimetre of the serum. In the case of (A) the serum had been absorbed with the homologous strains of the organisms used in the vaccine and in the cases of (B) and (C) it had not been treated in any way. The second dose was given one week after the first and consisted of double the first, both as regards the amount of vaccine and

serum given. In the case of (A) the general reaction after the first dose was indicated by malaise and headache, which made their appearance on the same evening as the inoculation took place. This had disappeared by the following morning. The local reaction was manifested by a reddening, slight swelling, and tenderness round the site of inoculation. This lasted about forty-eight hours. After the second dose there was no general reaction and very little local. In the cases of (B) and (C) the reaction was practically the same as in the case of (A), being perhaps slightly milder.

Two estimations of the opsonizing power of these men's serums were done. The first estimation was carried out on the fifteenth day after the second dose of vaccine, the second on the twenty-first day after. The serum on each occasion was first heated for twenty minutes at 55° C. to destroy the thermolabile or normal opsonins. The serum used as a normal control was also treated in the same way. The estimations were carried out by using a final dilution of serum of 1 in 12, and leaving the mixture of heated serum, washed cells, and emulsion of organisms in a water bath for fifteen minutes. The following table gives the results of the two estimations :—

TABLE IV.—Estimation of the Opsonic Indices.

		Opsonic index 15th day	Opsonic index 21st day
A	Shiga	3·1	4·0
	Flexner	3·5	14·3
	"Y"	2·0	12·6
B	Shiga	1·8	1·25
	Flexner	2·8	3·0
	"Y"	1·3	6·0
C	Shiga	1·6	2·75
	Flexner	2·5	2·5
	"Y"	1·8	6·3

The bacterial contents of 100 cells were counted in each case. In the first estimation, that done on the fifteenth day, the cells when mixed with the serum of the inoculated men gave the following average number of bacilli phagocyted per cell.

	Shiga	Flexner	"Y"
A	2·6	1·0	1·2
B	1·5	0·8	0·8
C	1·4	0·7	1·1
Control	0·8	0·3	0·6

On the second occasion the normal serum gave a count of 0·5 bacilli per cell with *B. dysenteriæ* Shiga, 0·3 with *B. dysenteriæ* Flexner, and 0·7 with *B. dysenteriæ* "Y." In this experiment not only is the superiority in opsonizing power of A's serum over the other two brought out, but it also shows the slow response of the body to the vaccine.

Complement Fixation.—This experiment is included as it demonstrates again the larger amount of immune body present in A's serum compared

with that present in the serum of B and C. The estimation was carried out on the fourteenth day after the second dose of vaccine had been received, and unfortunately the experiment could not be repeated later, so that no comparison between the amount of immune body present on the fourteenth day after inoculation and the amount present at a later date could be made.

The antigen used consisted of a twenty-four hour growth on agar of the three organisms used. One loopful (two milligrams) of the culture from the surface of the agar slopes was suspended in two cubic centimetres of normal saline. The serum to be treated was heated for twenty minutes at 55° C.

The following control experiments were carried out:—

(1) It was found that the antigen when diluted to 1 in 5 just did not cause mechanical deviation, so that a dilution of 1 in 10 was used for the actual test.

(2) The serum to be tested when diluted to 1 in 10, in the absence of antigen, bound 1 M.H.D. of complement, but not 1·5 M.H.Ds.

The actual test was then carried out with the results shown in the table. The final dilution of the serum was 1 in 40.

TABLE V.—Complement Fixation.

Serum	Antigen	Number of M.H.Ds. of complement found
A	Shiga	4·0
	Flexner	3·0
	"Y"	2·0
B	Shiga	2·0
	Flexner	1·5
	"Y"	1·5
C	Shiga	2·0
	Flexner	1·5
	"Y"	1·5
Control	Shiga	1·5
	Flexner	1·5
	"Y"	1·5

Conclusions.

(1) That inoculation against bacillary dysentery with this vaccine can safely be carried out, and from the results obtained, as far as they go, there seems to be some hope of reducing the case incidence of this disease in epidemic and endemic areas.

(2) That the use of this vaccine produces no negative phase, but that it is more difficult to raise the immunity of all individuals with dysentery vaccine than it is with vaccines against other organisms of the intestinal group. Also a period of about twenty-one days is required after the second dose of vaccine before the inoculated man fully responds to the vaccine in the way of producing immune substance. Where practicable, three doses of the vaccine, the third being the same size as the second, should be given for choice.

(3) That the length of time that the resulting immunity lasts has not been fully established, but that it is probably from four to six months, and may be reckoned analogous to that produced by inoculation against cholera.

(4) That in view of the above paragraphs wholesale prophylatic inoculation against bacillary dysentery is not advocated by the author, but it would seem reasonable to suggest inoculation at the beginning of the summer months among units and formations in which dysentery has been endemic, and among those in which there may possibly be carriers of the disease. The inoculation of troops among whom there has arisen a sudden outbreak of the disease would also appear safe, and in conjunction with other preventive measures might assist materially, I think, in its control.

The work contained in this paper has been accomplished in the main by workers and observers other than myself, the results of which have been merely collated and tabulated by me.

For access to these figures and results I am indebted to the courtesy of the Authorities at War Office and Colonel Sir William Leishman, C.B., F.R.S.

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[2] Castellani. *Brit. Med. Journ.*, February 26, 1916, p. 306.
[3] Ledingham and Penfold. *Brit. Med. Journ.*, January 8, 1916, p. 47.
[4] Kennedy and Rosewarne. *Brit. Med. Journ.*, December 23, 1916, p. 864.

THE TECHNIQUE OF AMPUTATIONS, PARTICULARLY THE TREATMENT OF NERVES.

By EDRED M. CORNER, M.C.Cantab., F.R.C.S.

Surgeon to the King George Hospital, the 5th London General Hospital, Queen Mary's Auxiliary Hospital, Roehampton, the John Ellerman Hospital, the Oakenshaw and other Red Cross Hospitals, St. Thomas's Hospital and the Children's Hospital, Great Ormond Street, etc.

In this War there is hardly a more frequently performed operation since the introduction of the Carrel-Dakin method, which seems to have banished most other major operations in the earlier phases of wound treatment, than an amputation. In consequence there have been many opportunities for the study of their results and the fact has been brought to light that the results of amputation could and should be very much improved. It is natural, and tends to improvement, that the technique of so frequently performed an operation should be criticized. The very frequency of the operation shows that this criticism must have widespread results. Amputations must no longer be some of the worst and most slovenly done operations. It must no longer be thought that the technique of amputations has reached finality and that the operation can be handed over to junior officers.

In civil life there is little or no opportunity for most of us, of knowing about the conditions of an amputation stump, its treatment and the incidents which may happen to it. At St. Thomas's Hospital in 1913, the year before the War, only thirty-four amputations of limbs were performed amongst 5,483 operations on patients admitted to the hospital. This is approximately one amputation in 161 major operations. Moreover, the great majority of these amputations were done by house surgeons and other young officers, particularly for sepsis and gangrene in the surgical beds of the infectious block attached to the hospital. Thus the cases escaped skilled, extended and critical observation and, not until this War, was erudite attention given to amputation stumps, such as is now done at the Queen Mary's Hospital, Roehampton, and daughter institutions, where it is found that a large number of the amputation stumps there certified ready to be fitted by apparently competent authorities are unfit for wearing limbs principally because of their tenderness. Others have sinuses which are unhealed and many have tender nerve bulbs. Yet such stumps are said to be ready for fitting an artificial limb! Truly knowledge of the study of amputation stumps is not widely diffused.

In performing an amputation the first structure to be dealt with technically is the skin in which flaps are cut, except in the guillotine operation, which is solely and amply justified in saving life. It is often used for laziness and then has no excuse for it. Whenever there is any

doubt it is better to make flaps and sew them back—one stitch for each usually suffices—to the skin of the limb, leaving the wound quite open for a few days, after which the flap is released. The very great majority of such amputations are done above the sepsis or nearly above the sepsis, and can be sterilized in a few days' time by the Carrel-Dakin method of wound treatment. The skin, connective tissue and muscles are dealt with adequately by flap cutting. In their turn vessels are treated satisfactorily by ligature, but to cut and to leave open nerves, muscles, connective tissue and bone exposed in a wound which is to be primarily or secondarily the seat of sepsis is wholly unsatisfactory, to say the least of it. A superlative stage of this inflammatory nerve irritation is occasionally seen in the chronic twitching of muscles which gradually spreads up the limb and progressively affects more and more of the trunk muscles, evidence of an ascending irritation, perhaps of an ascending neuritis. For a long time it was thought that the fact that a nerve was bulbous was sufficient to demand its excision. Slowly but surely it was found that though all cut

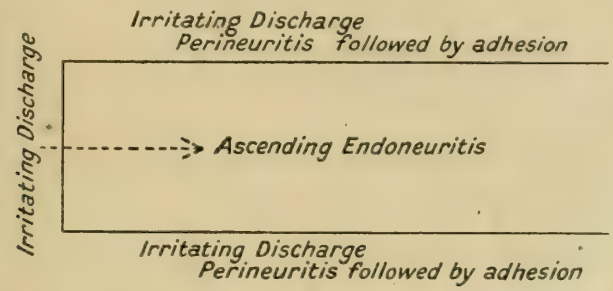


FIG. 1.—Diagram illustrating the inflammation around and the ascending inflammation within a nerve the end of which is exposed in an inflamed wound.

nerves were bulbous only a few were painful and needed removal. Then the idea grew that if a cut and healing nerve end was surrounded by inflammation, a kind of perineuritis, the nerve became adherent to the structures around it and was very apt to become painful. Very great difficulty was found in dissecting out such adherent nerves.

The formation of adhesions about nerve ends was an adequate reason for cutting the nerves short in the concluding stages of the amputation. If the nerve is pulled down strongly before being cut, it will retract, and the shorter a nerve is cut the further its open end is removed from irritation. Although sepsis travels up the connective tissue planes, particularly of vessels and nerves, the swollen and repairing cut ends of the muscles might prevent irritating fluids from reaching the cut nerve before its end was sealed by repair.

Such perineuritic inflammatory tissue was found to be formed in consequence of injecting the nerves, as with alcohol. Some of the injection escaped from the punctured sheath into the surrounding connective tissue

and led to its inflammation, the adherence of the nerve, and the consequences from the contraction of that scar tissue.

Clinically it was sometimes found that though there was benefit from excising the painful nerve ends, sometimes *the tenderness of the stump returned.* Operating on such a stump in the King George Hospital I found that some nerve fibres had grown from the imperfectly closed end of the short cut sciatic nerve, found their way along the connective tissue planes, as along a scaffolding, and had formed a new and sensitive nerve ending in the scar tissue of the stump. This was the case of Private T. C., 4196, Black Watch, transferred from the Queen Mary's Auxiliary Hospital, Roehampton, to my service at the King George Hospital. The stump was healed but very tender, especially along the sciatic nerve. The scar was excised together with a neuroma on the obturator nerve. The sciatic nerve was then exposed and excised.

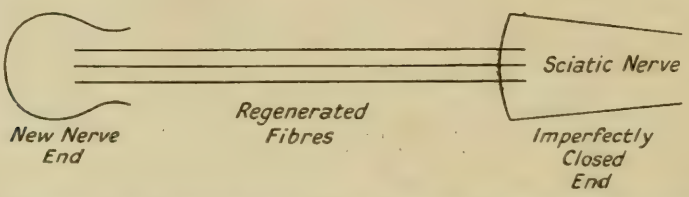


FIG. 2.—Diagram of the growth of nerve fibres from the imperfectly closed nerve end in an amputation stump, explaining the formation of a new and tender nerve ending, and emphasizing the desirability of closing the nerve.

Here was direct evidence that the fault lay in leaving the cut nerve end "open" and that tenderness of the stump, from regeneration of nerve fibres, may return if the cut nerve end is left open, even in the absence of all irritation.

Another type of the imperfect closure by sealing of the end of a nerve left open in an amputation wound was found in the course of my operations at the King George Hospital.[1] Where the adhesions were thickest around a nerve bulb it was often found that nerve tendrils existed extending from the bulb to neighbouring tissues. They varied in size and ended in nerve bulbs in the scar of the skin, for adhesion of the nerve bulb to which they were much responsible, or the muscles. The existence of such tendrils sprouting from the nerve bulb offers a possible explanation for the varying distribution and diffuseness of the pain clinically resulting "tender nerve bulbs," and also for the care with which the nerve ending must be treated and closed at the time of the amputation. In time almost all of the open nerve end is sealed, but from one, two, or more places a stray fibre, or stray fibres, regenerate and grow along the course of least resistance and are responsible for recurrent tenderness and pain in the stump, and,

[1] Pensioner, A. T. H., 9344, in A4.

probably, for some return of function. Such regenerations may take place in the absence of all sepsis. It is unusual to find more than two tendrils to each bulb, one is the usual number. The existence of tendrils is an argument in favour of removing all tender nerve bulbs.

A nerve end, left open in a healing suppurating amputation wound, often bathed in irritating fluids, no matter how short it is cut, receives a certain amount of irritation ; some of which is conducted to the interior of the nerve and sets up what may be called an endoneuritis, some to the exterior of the nerve where it sets up a perineuritis and leads to the formation of adhesions as in the cases just considered. In certain instances this irritation ascends the nerve and may be cured by the timely excision of the nerve nearer to the trunk. If it goes on, the irritation ascends

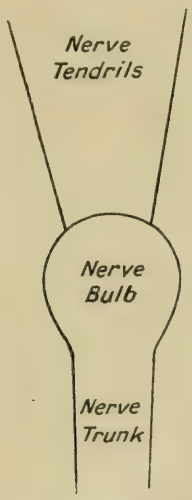


Fig. 3.—Diagram of regenerated nerve tendrils extending from end bulb of nerve to the neighbouring tissues, causes of irregular and diffuse pains in amputation stumps.

higher in the nerve and it may be necessary even to divide nerve roots after performing a laminectomy. Occasionally it reaches the cells of the anterior horn of the spinal cord and perhaps it may ascend higher. Clinically it would appear that the higher the nerve irritation goes the more is it preceded and surrounded, like a penumbra by a wave of functional disturbance which allows the condition to be recognized and cured before the irritation gets too high. In bad cases the irritation may have proceeded beyond the reach of surgery. The accompanying "functional" elements in the disease may be alleviated by rest and medical treatment and in time the nerve irritation may die out and the patient recover. The treatment of these patients is twofold, surgical and medical ; and both should be carried out contemporaneously.

On the two grounds of the irritation, outside and inside the divided and open nerve, it is urged that attempts should always be made to deal with

divided nerves as is done in the skin by flap-cutting, or in the areolar tissue and in the muscle dividing, and in the ligation for the divided vessels. The intelligent procedure is to close the open nerve, as by a ligature after proximal and several crushings of the nerve with artery forceps. As the divided end of the nerve will be sealed in a few hours, the ligature should only be of the finest and most quickly absorbed catgut.

The end of the nerve, capped by sterile crushed nerve tissue, is then covered, sealed and held in place by the ligatured nerve sheath. As the crushing of a nerve trunk might cause a stimulus to reach the spinal cord of the unconscious patient, and cause a large fall of blood-pressure, it is desirable to block all large nerve trunks with a novocain injection before crushing them. Or nerve flaps may be cut so as to close the open end. The latter proceeding demands a nerve end large enough for the manipulation, e.g., the sciatic, whilst the former method, ligature and proximal crushing, is applicable to any nerve large enough to be visible to the naked eye.

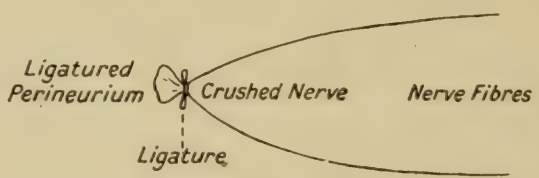


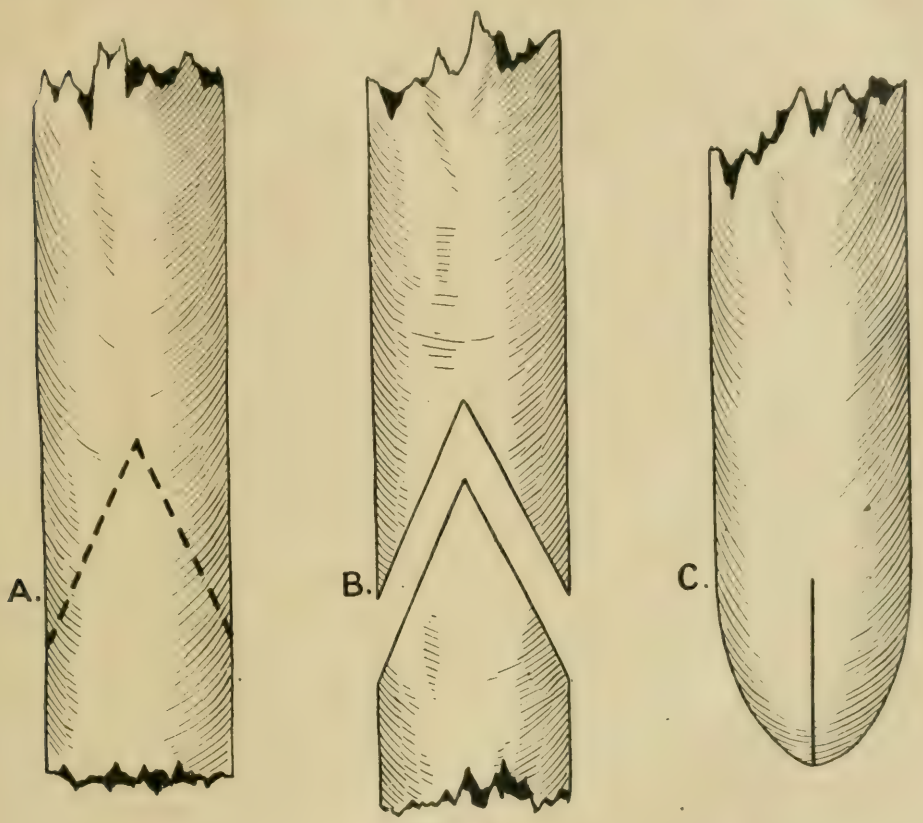
FIG. 4.—Diagram illustrating the closure of a nerve by ligature of its well-crushed end.

There is always an unhappy feeling that from time to time, and in spite of all care, a nerve filament may have escaped crushing and dividing. When ligatured with an unabsorbable material like silk, it would be very painful, so that when the nerve is large the most practical thing to do is to pull it down, *divide it by two cuts*, making rather long flaps, one from each side, so that the cut nerve end becomes closed as in fig. 5, by the pressure of the surrounding structures, as it retracts. This proceeding is shorter and simpler than any flap cutting. Smaller nerves should be pulled down so strongly before they are divided that they may even be avulsed. Avulsion of a large nerve may cause injury in the spinal cord. It is better to divide these nerves, with two opposing cuts making them as short as possible so that their cut ends lie far from the irritation of the septic and healing wound. In a few hours their open ends will be sealed by a membrane of fibrin whilst they are protected from the fluids in the wound, by the bulging and pressure of the surrounding tissues.

These two ways of dealing with large and small nerves are the most practical means of dealing with the nerves in an amputation. No nerve ends should ever be left lying open in a healing wound, amputation or otherwise. It has never been found that flaps of perineurium are to be relied upon to close the nerve. Their making prolongs the operation and is no obvious gain.

This faulty treatment of divided nerves is the principal cause of the lasting tenderness of many a painful stump.

Then, do we treat the divided bone properly? I do not think so. Attempts have been made to close the end of the divided bone with periosteum and osteoplastic flaps. These never have succeeded. The



A. The dotted line shows the direction of the incisions.

B. The incisions.

C. Retraction after the incision producing a falling together of the flaps which are pressed together by surrounding tissues.

FIG. 5.

great majority of sinuses in amputation stumps lead to necrosed bone, primarily necrosed by the thrombosis of vessels brought about by the heat generated with the saw cuts[1] and secondarily infected. The saw is a useful instrument in amputation, but there could be better technique.

[1] Messrs. Allen and Hanburys are constructing a saw for the author minimizing the amount of heat so generated.

There would not be nearly so many stump sinuses if its use were discarded for a guillotine.

The open bone in an amputation stump is similarly situated as regards the sources and effects of irritation as is an open nerve; corresponding to the perineuritis and the endoneuritis are periostitis and osteomyelitis (see fig. 1).

Much divided muscle is left "open" in the amputation wound and is therefore exposed to all the accidents which we know affected a similarly placed nerve or bone, peri- and endo-myositis, such as is the cause of temporary and diffuse tenderness of a stump shortly after operation. Cut muscles could be sealed with a continuous catgut suture. It is remarkable how such closing lessens the amount of the fluid exuded and discharged from the wound. This examination of procedure would ensure the identification of all the divided structures. Most surgeons have at one time or another failed whilst doing an amputation to find even so large a structure as the sciatic nerve on account of its retraction. The identification and separate treatment of the various structures in an amputation stump would alike benefit both surgeon and patient and should be done if the anæsthetist permits.

To sum up, the technique of amputations should be revised in many particulars. The treatment of the divided skin, connective tissue and muscles appears satisfactory. The treatment of divided nerves is not satisfactory and I would suggest flap cutting for large nerves and crushing the nerve proximal to the point of division with ligature (quickly absorbable) of the divided and crushed ends for small nerves. The method of dividing the bone is not satisfactory. Divided muscles should be closed so that inflammation may not ascend in them. In fact, the skin of no amputation wound should be sutured until all open structures, except perhaps bone, have been sealed. In the clinical importance of their closing, these may be placed in order: vessels (an immediate danger from hæmorrhage), nerves and bone (causes of remote disabilities and necessitating further operations for tender ends, necrosed fragments, etc.); the other structures like muscles seal themselves in time. A few well-placed stitches shorten the time of convalescence greatly.

X-RAY WORK IN A BASE HOSPITAL IN FRANCE: A FEW OBSERVATIONS OF A PRACTICAL NATURE.

By Captain B. H. STANLEY AYLWARD.
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War X-ray work, except possibly in hospitals in England, differs essentially from peace-time work. Treatment need not be considered, except perhaps as an amusement for the radiologist when he finds himself, as he sometimes does, with very little to do.

The important thing for the radiologist to grip on to on being sent abroad is that rapidity in his work is the first thing required of him. The more cases he can handle in a given time, the more use he will be to his unit. He will soon find that the more efficient he becomes, the more work he will be asked to do, until in a rush he will get in one day more than he can possibly do in three; then it is that he realizes the importance of seconds saved in each case. Let him work as hard as he may, cases, on which X-ray reports have been asked for, will be evacuated before he can get them done. Rapidity in handling cases therefore is of the utmost importance.

To have a practical experience of War surgery is a great assistance to the War radiologist, as it enables him to know what the surgeon requires, and so he avoids wasting his own time on unnecessary work, and often saves the operator much trouble and annoyance. He must endeavour therefore to combine speed with accuracy, and to serve up to the surgeon the information he requires in as practicable a form as possible. As regards outfit he will probably have to take what is given him, although any reasonable indent is passed if the article can be obtained. The man who cannot work without a whole lot of special apparatus is usually not much use, even when his demands have been satisfied. The more simple the outfit the better, complication usually means time wasted in handling the cases. But, whatever the outfit be, it must be kept tuned up to the very highest pitch; if anything shows signs of getting out of order, it must be put right at once; there may be a rush of work the next day, and the machine will probably break down.

The table must be so arranged that the patient has not to be moved off the stretcher. This can easily be done by removing the top, and fixing a cross-piece of wood at either end, on which the handles of the stretcher rest. All the work can be done quite satisfactorily on a stretcher, and no time is wasted in lifting the patient on and off the table, an undertaking which is often troublesome to the radiologist, and painful to the patient.

A tube-box underneath the table, which can be easily and quickly moved, preferably with the foot, is necessary, as every case must be thoroughly screened, otherwise many foreign bodies will be missed. In a

limb it is advisable always to screen at least to the joint above and below. In the trunk it depends upon the case, but often it will be necessary to screen the whole chest, abdomen and pelvis: at all times it is better to err on the safe side. The overhead tube box is very rarely required, and unless it is part of the table is most unsatisfactory, as the floors of most hut hospitals are very lightly constructed, and anyone moving in the same hut causes the overhead tube to oscillate considerably.

Some form of apparatus for taking lateral heads is advisable: Major Higham Cooper's is quite satisfactory, and is easily used on a stretcher; antero-posterior heads can also be taken in it by removing the rubber cushion and using the underneath tube; the woodwork appears to stop very few rays. In the majority of cases it is quite unnecessary to take plates, and it will be found that most surgeons prefer accurate markings to plates in all ordinary straightforward cases. Plates of a foreign body lying in the muscle of the thigh are of little use to the surgeon, but if the foreign body is marked in the manner to be described, the surgeon at once realizes where it is.

A foreign body should therefore if possible be marked on the skin; plates may be taken as well if desired, but the surgeon will probably be guided by the marks. The only exceptions to this rule are joints and head and neck cases, or where it is wished to show a fracture. Marks round joints and on the neck are apt to be misleading, as the slightest alteration in position upsets even the most careful marking. Plates have not this disadvantage to the same extent; two must always be taken, an antero-posterior and a lateral whenever possible.

Three colours are required for marking, say green, red and blue; green is used for antero-posterior, red for lateral, and blue for the nearest point on the skin when the foreign body is superficial. Ordinary microscopic stains do very well and should be kept in a small bottle with an india-rubber cork, the cork being used for making the mark.

The tube must be carefully centred so that the central ray passes vertically upwards through the exact centre of the diaphragm. A metal marker with a small ring at one end, of a suitable size to take the india-rubber cork of the stain bottle is required; it is an advantage to have the handle of the marker made out of a piece of brass tubing, as when the cut end of the tube is pressed up against the skin, it leaves a small ring depression which is easily distinguished and upon which the mark is placed.

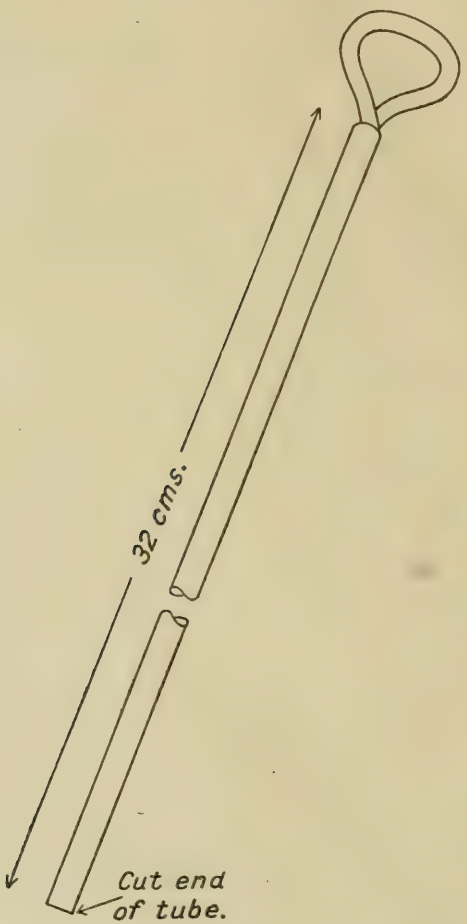
The patient is lying on the stretcher, which is on the framework of the table; he must be placed absolutely flat on his back or abdomen according to circumstances, with the inner borders of his feet pointing directly upwards. In a very few cases it will be found that the patient cannot be got into this position, he must then be placed in some convenient position that can be described accurately, so that the surgeon may be able to place him in the same position again on the operating table, otherwise the

marking will probably only be misleading. He is screened and a foreign body found.

It is usually best to make the lateral mark first, as the second antero-posterior mark often involves moving the patient. The blunt end of the marker is placed up against the skin laterally opposite the foreign body at more or less the supposed depth. The tube is now moved longitudinally and the movement of the foreign body and the end of the marker compared; if the marker moves most it is too far from the screen and must be tried closer. Finally a position is found where the end of the marker and the foreign body move together when the tube is moved. The light is then turned on and the place marked in red. The diaphragm is now closed and the tube moved until the foreign body is in the centre of the circle of rays; the ring of the marker is then placed over the foreign body, the light turned on and a green mark made by pressing the cork of the stain bottle on the skin through the ring. Finally a second antero-posterior mark is made in exactly the same way, but with the marker underneath the patient, it is usually necessary to turn the patient or lift the limb in order to make this mark on the skin. If the first antero-posterior and the lateral marks come fairly close together it is not really necessary to make the second antero-posterior mark, as it will be so far away from the foreign body as to be practically useless to the surgeon. Sometimes in limbs it is advisable to make two lateral marks, one on each side of the limb. A little practice is required in judging the difference of movement of the foreign body and the end of the marker, but once this is acquired the method is very quick and very accurate. It is advisable to open the diaphragm pretty wide and take a good long sweep with the tube, as of course the greater the movement of the tube, the more accurately the depth of the foreign body is gauged. There are several instruments designed for getting the depth of the foreign body by screening, but they all take much longer to use, and to tell the surgeon that the foreign body is so many centimetres deep to the mark on the skin does not convey as much information to him as a lateral mark accurately placed.

The method of turning the patient so as to make the lateral mark in the same way as the antero-posterior marks certainly takes more time than the method described above, and the results are often inaccurate, as it is very difficult to say when the patient has been turned exactly through a right angle. If the foreign body is superficial, that is, not more than one centimetre deep, one mark on the skin is sufficient; it is easier in this case to rotate the patient or limb until the position is found where the foreign body appears nearest to the skin, the blunt end of the marker is then placed on the skin and the spot is found from which the foreign body is most easily moved. The tube is then moved and the movement of the foreign body and the end of the marker judged as an extra safeguard. The place is marked in blue. If the surgeon makes an incision through the mark towards the centre of the limb or trunk he will strike the foreign body.

The practice acquired in judging whether the point of the marker is above or below the depth of the foreign body is very useful in the removal of foreign bodies under the rays, and it enables the radiologist to assist the surgeon by removing any foreign bodies which cannot be got by the usual operation on account of their small size or the position they lie in. It is a good plan to explain the system of marking to each of the surgeons, and



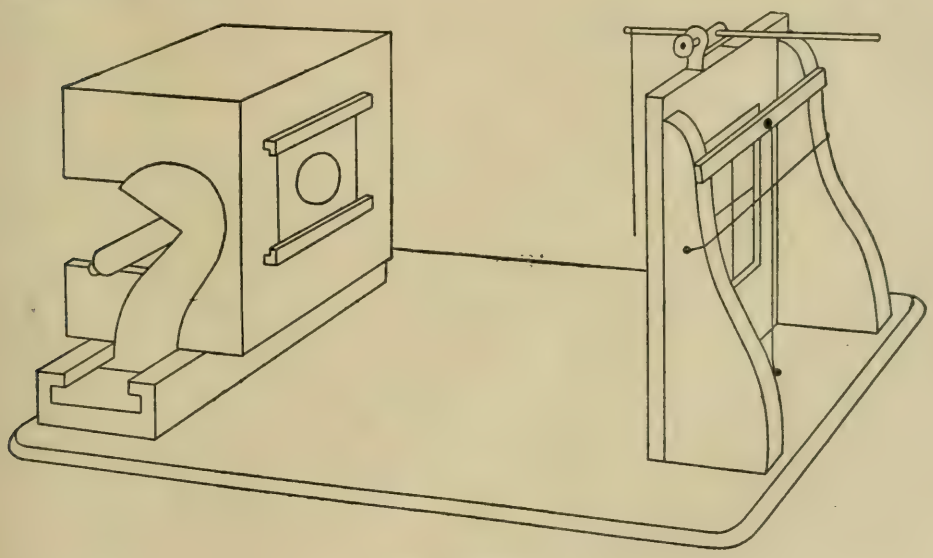
Sketch of marker.

to put up in the operating theatre a notice explaining exactly what the different coloured marks mean. It also helps the surgeon if a rough drawing of the size of the foreign body is sent in on the report.

The arm will be found to be a difficulty often, as sometimes the foreign body is in an awkward place to get at, and in many cases the patient cannot place the limb in the position required, the only thing then is to take some convenient position and describe it carefully on the report.

Foreign bodies lying deeply in the trunk are best marked either on the back or front in the antero-posterior position, and the depth then worked out either by stereoscopic plates, if there is a likelihood of bone injury, or by the two photographs on one plate method, which gives the depth accurately and is quicker than the stereoscopic, or one of the methods of getting the depth by screening may be used if preferred.

In head cases antero-posterior and lateral plates are usually sufficient, but it is often very difficult to say from them whether the foreign body is inside the skull or not. If there is any doubt, or if a more exact localization is required, then two small plates must be taken, the first being a plan plate with the tube in the central position, the second with the tube movement of six centimetres, the estimated nearest point on the scalp being placed in contact with the cross wires. If the cross wires are marked on the skin it is very easy afterwards to mark the actual nearest point and give the depth, by using the same method as described below for eye work.



Eye apparatus.

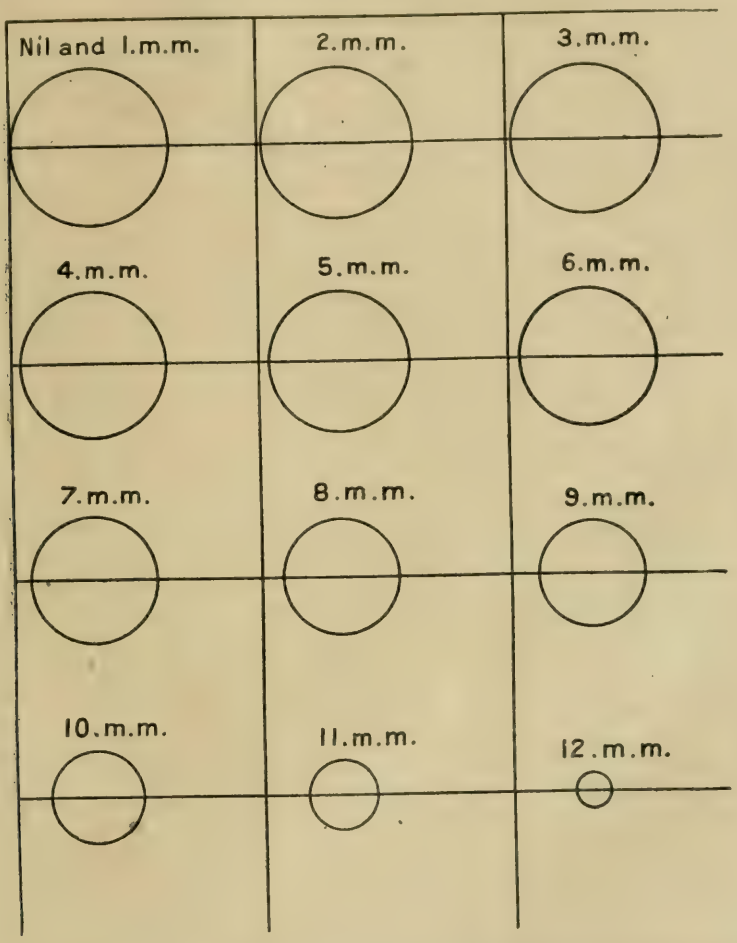
Eye localization is a special branch of the work which the radiologist abroad may be called upon to do, and probably he will have no special apparatus. A simple form of apparatus which gives very accurate results can be made with the help of the hospital carpenter and a little ingenuity. The apparatus in use in this hospital was evolved from the idea of Major Higham Cooper's head apparatus, and was made in the hospital. It consists in a base board forty by seventy-five centimetres, on one end of which is fixed a tube box movable in a transverse direction six centimetres each side of the central position. Fifty centimetres from the anticathode

is fixed transversely at the other end of the board a solid upright frame holding an old full plate with two cross wires stretched across it, the horizontal wire being twenty centimetres above the base board. About five centimetres behind the glass plate are stretched two more cross wires corresponding to the two on the glass plate. On the top of the upright frame holding the glass plate is fixed a metal pointer with a universal joint so arranged that the point can be fixed in contact with the skin, just above or below the patient's eye when he lies in the apparatus. The tube with the tube box in the central position is centred accurately on the two sets of cross wires so that when the anticathode is sighted from the other end of the apparatus through the glass, first come the nearest cross wires, then the cross wires on the glass, and these coincide accurately with the centre of the anticathode at the other end of the apparatus. The patient lies on his back on the table or stretcher with the side of his face to be photographed up against the glass plate, an arrangement of canvas straps is used to fix the head firmly, once he is in position. Under his head is placed the india-rubber cushion of Major Higham Cooper's head apparatus, which is blown up or deflated to raise or lower the head as required. Longitudinal movement is obtained by moving the whole apparatus on the table or stretcher. The patient's head is now arranged so that the centre of the front of his cornea coincides with both sets of cross wires when sighted in the same way as when the tube was centred, and it is fixed in that position. The metal pointer is lowered until it touches the skin either just above or just below the patient's eye, and moved laterally until it lies in the same antero-posterior vertical plane as the centre of the cornea, when it is locked in position. A plate is placed up against the back of the glass plate. The central ray now passes through the centre of the front of the cornea on to the plate at the point where the cross wires intersect. From this plate we can say how far above or below the central corneal axis and how far in from the plane tangential to the centre of the anterior surface of the cornea a foreign body lies, simply by measuring the distance on the plate of the foreign body from the wires (a small correction must be made for the divergence of the rays if absolute accuracy is required). The tube box is now moved six centimetres, usually away from the patient's shoulder, and a second plate taken. By measuring the movement of the pointer and of the foreign body on the two plates, it is easy to calculate how much nasal or temporal the foreign body lies.

A simple method of finding out whether the foreign body is in the globe is to have a series of circles drawn on a piece of transparent paper corresponding to vertical antero-posterior sections of the globe at millimetre distances from the central vertical antero-posterior plane (for practical purposes the globe may be taken as a sphere having a diameter of twenty-five millimetres). The position of the cross wires must be marked in for each circle. The plan plate is placed on the corresponding circle (so many millimetres nasal or temporal) with the cross wires coin-

ciding with the cross wires on the paper. If the foreign body comes inside the circle it is inside the globe.

The details of constructing the apparatus have been left to the individual ingenuity, as so much depends on the material and workmanship available.



Sizes of vertical antero-posterior sections of globe at millimetre distances from central vertical and posterior plane.

This article does not pretend to any originality, but it is an endeavour to explain the method used after a year's experience of X-ray work in a Base Hospital in France, in the hope that some of the ideas may be of use to the radiologist who is sent abroad. Acknowledgments are due to Captain B. T. Lang, R.A.M.C., for the idea of the pointer fixed on the eye apparatus, which is a great improvement on the old method of sticking a piece of fuse wire on the lower lid with plaster, and to Captain G. T. Loughborough, R.A.M.C., for the method of finding whether the foreign body is in the globe.

PRELIMINARY AGGLUTINATION IN THE ISOLATION OF TYPHOID AND DYSENTERY BACILLI FROM THE EXCRETA.

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From the Laboratory of the University War Hospital, Southampton.

At the present time many workers are engaged in examining convalescents from typhoid, paratyphoid and dysentery. Several equally satisfactory methods are employed for the detection of carriers, but I would urge that the method of preliminary agglutination is more simple and more economical than those in general use and is, at least, as efficient.

The following is the procedure adopted in this laboratory :—

Collection.

The urine is collected in large stertile test-tubes ten inches by one inch, incubated for twenty-four hours at 37° C. and then plated on Endo's fuchsin-sulphite-agar. Incubation is necessary because the urine may contain pathogenic bacilli in very small numbers. On several occasions, in this laboratory, plates inoculated from the fresh urine have remained sterile while there has been a profuse growth on plates prepared from the same urine after incubation.

The fæces are brought to the laboratory in sterilized six-inch petri dishes. The consistency and any abnormal constituents of the sample are noted and a microscopical examination is made for the purpose of detecting protozoa, or the ova of entozoa. With a piece of stiff iron wire, known as bird-cage wire, 10 centimetres long, bent up at one end into a hook 1 centimetre in diameter, a portion of the fæces the size of a large bean is transferred to 5 cubic centimetres of sterile salt solution in a test-tube. The wire is twirled rapidly between the finger and thumb, so that the fæces are beaten up into an emulsion with the salt solution by the revolving hook. The tube with the wire still in it is then incubated for one hour at 37° C.

Plating.

This is carried out by two methods: (1) Direct plating on Endo's medium ; (2) brilliant-green enrichment.

(1) *Direct Plating.*—Two large platinum loopfuls are taken from the emulsion after incubation and are spread on a plate of Endo's fuchsin-sulphite-agar.

(2) *Brilliant-green Method.*—Two large platinum loopfuls of the

emulsion are put into a tube of brilliant-green peptone water (0·5 brilliant-green, 1/100 solution, to 1 litre of peptone water). This is incubated for twenty-four hours and is then spread on a plate of lactose-litmus-agar (one per cent lactose in ordinary nutrient agar with litmus as an indicator).

Preliminary Agglutination.

The "likely" colonies on the plates are tested at once with agglutinating serums as follows: two combined agglutinating serums are prepared from serums supplied by the Lister Institute of Preventive Medicine.

The first is a mixture of those serums which agglutinate the members of the Eberth group; the second contains those which agglutinate the bacilli of the Gaertner group.

They are prepared by mixing, in two test-tubes, one cubic centimetre of each of the following agglutinating serums :—

Tube 1, Eberth Group	*B. typhosus* serum *B. dysenteriæ* (Shiga) *B. dysenteriæ* (Flexner)	one cubic centimetre of each
Tube 2, Gaertner Group	*B. paratyphosus* A serum *B. paratyphosus* B serum *B. enteritidis* (Gaertner) serum	one cubic centimetre of each

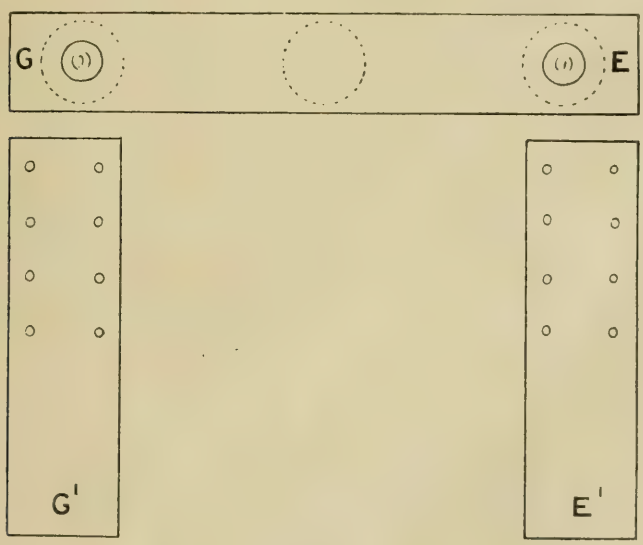

Fig. 1.

Moist-chamber slide with drop of Gaertner serum G, and drop of Eberth serum E. G' = Ordinary microscope-slide with 8 minute drops of Gaertner serum. E' = Ordinary microscope-slide with 8 minute drops of Eberth serum.

The combined serums can be kept in sterile test-tubes for weeks, without losing their efficiency. One phial of each serum, that is three cubic centimetres of the combined serums, is sufficient for the preliminary examination of several thousands of colonies.

In order to apply the test a drop of Eberth serum is put into the

depression at one end of a hollow-ground, moist chamber slide and a drop of Gaertner serum in the depression at the other end. Two ordinary, plain microscope slides are placed at right angles to the hollow-ground slide, one below each of the little pools of serum.

With a pipette drawn out to the fineness of a hair, some of the serum is taken up from the hollow-ground slide and a series of minute drops is placed in rows on the surface of the plain slide; the drops of Eberth serum on one slide and the drops of Gaertner serum on the other (see fig. 1). The drops must not be too large, or they will run down the slides when they are moved.

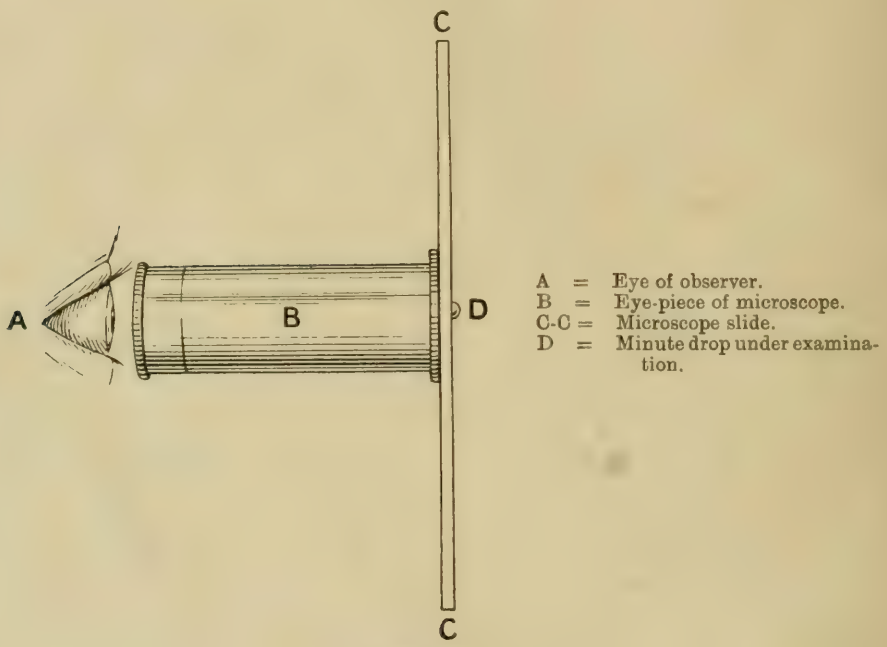

Fig. 2.

With a platinum needle, flattened at the end like a spatula, a portion of the first colony to be examined is emulsified in the top left-hand droplet on each slide.

If the colony consists of typhoid, paratyphoid or dysentery organisms agglutination will take place in one of the two drops within a few seconds. The actual number of seconds depends upon the specific serum employed. Of two serums, almost equal in titre, one may produce agglutination more rapidly than the other. The Lister Institute serums which I have used here cause agglutination to take place on the slide well within sixty seconds.

If there be no agglutination the next suspicious-looking colony is examined in the same way in the next drop of serum on each of the slides.

The occurrence of agglutination is most readily detected by holding up the slide before a dark background, putting the small lens of the eye-piece of a microscope against the back of the slide and looking through the large lens at the other end, which should be held close to the eye (see fig. 2).

In those cases in which a colony agglutinates with one of the combined serums, subcultures are made on three agar slopes. The first is required for agglutination tests, the second for cultural reactions and the third is kept for carrying on the strain. On the following day, the first of these cultures is tested with drops of the three agglutinating serums (separately) which are contained in the combined serum that agglutinated the colony of which it is a subculture. For instance, if the original colony agglutinated with Gaertner combined serum, the subculture on agar is tested in the same way on a slide, with drops of paratyphoid A, paratyphoid B, and enteritidis serums.

Agglutination Titre.

When it has been determined which of the specific serums agglutinates the organism, the next step is to find the highest dilution of the serum at which agglutination occurs. For this purpose an ordinary diluting pipette is employed, graduated in nine equal parts by means of a small bead of mercury. Drops of salt solution are placed in a row on a porcelain tile. The first drop contains nine parts, and each of the others contains five. One part of the specific agglutinating serum is added to the first drop, making a dilution of 1/10. From this, 5 parts are carried on to the second, 5 drops from this to the third, and so on to the penultimate drop from which 5 drops are discarded.

Each drop now contains 5 parts in dilutions of 1/10, 1/20, 1/40, 1/80, etc.; the last consists of salt solution only. To each drop are now added 5 parts of an emulsion made by adding 5 cubic centimetres of salt solution to a twenty-four hour culture on agar, of the bacillus under test. This will make the dilutions of the specific serums 1/20, 1/40, 1/80, etc.

The drops are now taken up into a long fine pipette, fitted with a teat, beginning with the last drop, the control. Between each drop air is sucked up into the pipette so that there is an air space between each drop and the next, equal in length to the space occupied by one of the drops. Each drop and each space should occupy about one centimetre of the length of the pipette.

After taking up the last drop the end of the pipette is sealed in the peep-flame, and the pipette is floated on the surface of a water bath at 55° C. for two hours.

At the end of this time the tube is examined for agglutination with the eye-piece of a microscope, employed in the same way as mentioned above, and the titre of agglutination is recorded.

The pipette is then placed vertically in plasticine for one hour, when it is examined again with the lens.

The pipettes are made from broken test-tubes by pulling them out in the blow-pipe flame. The capillary tubes, made in this way, are luted with plasticine, into a short piece of glass tubing fitted with a teat (see fig. 3). When the drops have been taken up from the porcelain tile into the pipette and the distal end has been sealed, the teat is carefully removed from the butt, the capillary tube is withdrawn from the plasticine luting and the proximal end is sealed.

The capillary tube is threaded, stitch-wise, through two slits in a small piece of paper, bearing the name or number of the culture, and is floated on the surface of the water bath. A most satisfactory water bath is the ordinary diet tray, supported at each end by a biscuit tin. This bath is very useful for carrying out agglutination tests by Professor Dryer's method, as it will hold a large number of the small metal stands which are employed in that procedure.

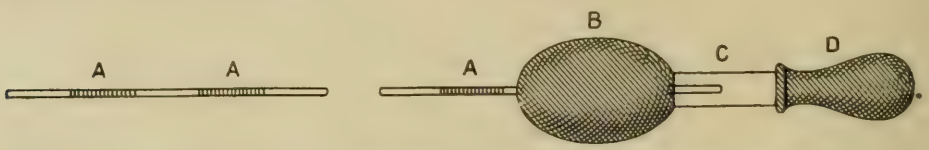

FIG. 3.—A, dilutions of serum with bacillary emulsion; B, plasticine luting; C, glass-tubing; D, teat.

CULTURAL TESTS.

From the second tube of agar cultures the following media are inoculated: litmus milk, peptone water, gelatine and tubes of litmus-peptone-water containing, severally, one per cent of each of the following: lactose, saccharose, dulcite, glucose, maltose, mannite and dextrine. (Owing to its high price dulcite has been used in this laboratory as a confirmatory test only.)

It is important to note the changes that take place in these media from day to day, for at least a fortnight, in those cases which appear to be positive. By this means now and then a masquerader may be discovered which would otherwise have escaped detection. Some organisms give the cultural reactions of the Gaertner group up to the seventh or eighth day and then ferment lactose.

For keeping the daily records of the cultural reactions I have found "sectional" paper very useful. It is employed as shown in fig. 4. The fine horizontal lines divide each square into five parts, so that each division equals 0·2 of the height of the square. The proportion of gas in the Durham's tubes is recorded from day to day in much the same manner as the temperature is recorded on a temperature chart.

The tubes after inoculation are placed in labelled jam-pots, which are put into the incubator. When they are examined, they are put in order in a test-tube rack. Plugs of coloured wool are employed to distinguish the different media. A roll of unbleached calico with pockets and elastic loops

(see fig. 5), something like the roll in which the tools of a motor-bicycle are kept, is useful for keeping the tubes in the same order as that in which they are recorded on the sectional paper. When they are removed from their test-tube rack, after inoculation, the tubes are slipped into the pockets of the roll, which is then folded up and put into a jam-pot before being placed in the incubator.

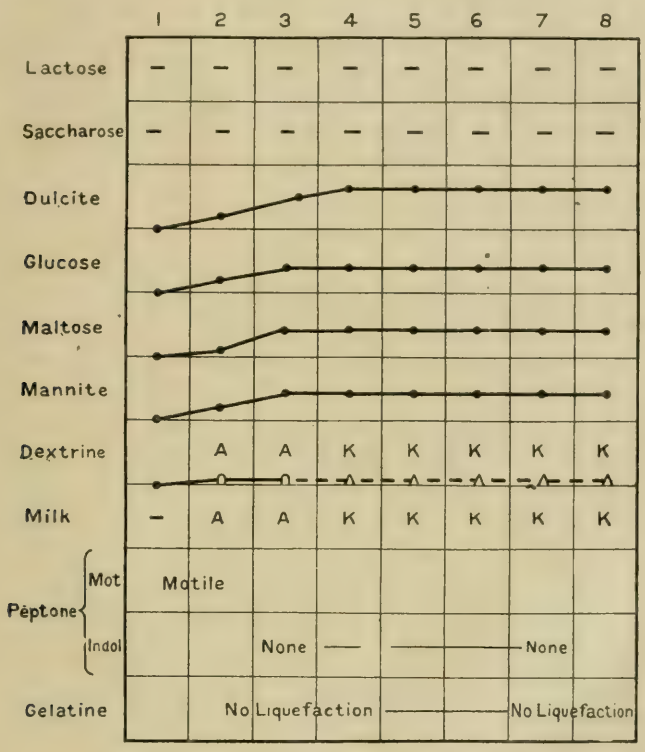

FIG. 4.

● — ● — ● = Acid and gas.
∩ .. .. = Acid bubble.
∧ .. .. = Alkaline bubble.
A .. .. = Acid.
K .. .. = Alkali.

The culture in the tube of peptone-water is examined for motility within eighteen hours of being inoculated. On the third, and on subsequent days, the same culture is examined for the presence of indol by the rosindol method. For this purpose about 0·25 cubic centimetre of the peptone-water is taken up in a Pasteur pipette, the end of which has been flamed, and is put into a small tube, such as those used for Dreyer's agglutination test. An equal quantity of paradimethyl-amido-benzaldehyde is added, and, after the reaction has been noted, a similar quantity of sodium persulphate solution. This method is economical in reagents, and enables one to make repeated examinations of the same culture during a period of many days. It is important not to omit this examination for indol.

Morgan has drawn attention to a group of organisms which give fermentation reactions similar to *B. paratyphosus* B, but which produce indol. I frequently met with examples of these bacilli in August and September, 1916.

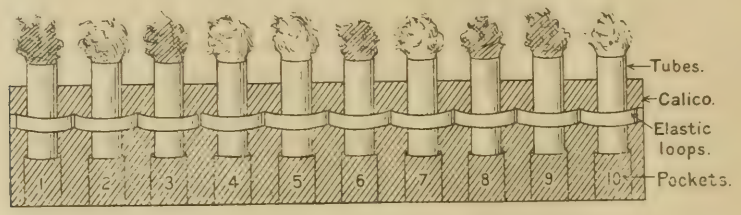

Fig. 5.

Saturation.

For further confirmation, saturation tests are applied as follows :—

An emulsion of the organism which is being investigated is made by adding one cubic centimetre of salt solution to each of three twenty-four hour cultures on agar slopes.

To 0·9 cubic centimetre of this emulsion is added 0·1 cubic centimetre of the specific agglutinating serum. The serum is thus diluted 1/10.

The tube containing the mixture is placed in a water bath at 45° C. for two hours. The mixture is centrifuged, the supernatant fluid is pipetted off, and to it is added an equal quantity of the bacillary emulsion, making the dilution of the serum 1/20.

The mixture is placed in the water bath for two hours, centrifuged, and an equal quantity of bacillary emulsion added, as before.

After being kept in the water bath for the third time, the supernatant fluid is removed with a pipette, after centrifugalization. The dilution of the serum is now 1/40.

A similar procedure is carried out simultaneously with an emulsion of a stock culture of the bacillus homologous with the agglutinating serum. The serum, after saturation with the bacillus under test, and the serum after saturation with the homologous stock bacillus are now taken, and the powers of each, in agglutinating emulsions of the test bacillus and of the stock bacillus, are investigated and compared with each other and with the agglutination titre of the same serum with these emulsions when it is unsaturated. This method takes up a good deal of time, and any method which does this is in danger of being scamped when work is very pressing. Harvey has shown that it is advisable to carry out saturation tests on all apparently positive cultures. The method which he has employed is much more simple, and takes up less time. He describes it as follows :—

"About 0·5 cubic centimetre of the serum was placed in a watch-glass, and the whole of an agar culture of the bacillus to be tested was rubbed up in the serum to form a very thick emulsion. This was then pipetted into a narrow tube, which was plugged with cotton wool, placed in the incubator at 37° C. for three hours, then removed and centrifuged, and the

clear supernatant fluid used for the subsequent tests, either in sedimentation tubes or simply as a drop on the slide for the macroscopic method, a portion of the cultures being rubbed up in the drop."

The Drawbacks and Advantages of the Method of Preliminary Agglutination.

Drawbacks.—The two chief objections to the preliminary employment of an agglutinating serum in the detection of colonies of pathogenic organisms on a plate prepared from the excreta, are:—

(1) Certain non-pathogenic organisms are agglutinated by the specific serum in low dilutions.

(2) Some strains of pathogenic organisms are non-agglutinable, and escape detection.

These objections will be considered separately:—

(1) Harvey, working in India, met with bacilli on several occasions, which were agglutinated at once by paratyphoid serum, but were proved subsequently not to be true paratyphoid bacilli. He writes: "Such bacilli are extraordinarily common in fæces, and it is peculiar that the serum which is most often at fault is that for paratyphoid A." Clemesha has shown how different are the bacteria found at different seasons of the year, and at different places. I have not encountered these bacilli amongst the convalescent soldiers examined in this laboratory. In eight instances colonies were found which agglutinated on the slide with a drop of Flexner serum, but which were not dysentery bacilli. Such organisms are eliminated by the subsequent confirmatory tests: the cultural reactions, the titre of agglutination with immune serum, and by absorption.

(2) Many workers have reported the isolation of enteric and dysentery organisms which are not agglutinable. Strains that do not agglutinate with the low dilutions of high titre serums employed in this laboratory must be very rare indeed. McIntosh and McQueen, in 1914, stated that there was at that time no record of the isolation of an inagglutinable strain from a typhoid carrier. The serums are prepared at the Lister Institute, and diluted from 1/10 to 1/25 before being sent out. As stated before, they are combined into two groups by mixing equal parts of typhoid, Shiga and Flexner serums in one tube, and, in another, Gaertner and the two paratyphoid serums, so that the original dilutions are trebled before the combined serums are employed in the detection of "positive" colonies. To give an example, the typhoid agglutinating serum is supplied diluted to 1/20, and is thus diluted to 1/60, before use. The titre, as stated on the phials, is 1/8,000. It must be extremely rare to find a strain of typhoid, even when first isolated, which will not agglutinate with a serum having a titre of 1/8,000 when diluted to only the extent of 1/60.

Logan states that he isolated non-agglutinable strains from the blood of fifteen cases of undoubted paratyphoid fever. He does not give details of their cultural reactions, nor does he say if they absorbed the specific agglutinins from a paratyphoid serum. An organism which is neither

agglutinated by a powerful paratyphoid immune serum, nor absorbs the agglutinins from it, is not a paratyphoid bacillus, A or B, whatever its cultural reaction may be.

In 345 cases control examinations of the plates prepared from the excreta have been made in this laboratory by the usual fermentation methods, but in no case have pathogenic bacilli been isolated which had not been detected already by the preliminary agglutination test.

Of these 345 patients 288 had suffered from typhoid or paratyphoid fever, 57 had suffered from dysentery.

B. typhosus was isolated from	4	convalescents
B. paratyphosus A was isolated from	2	,,
B. paratyphosus B was isolated from	22	,,
Total ..	28 = 8·11 per cent of 345	

In nineteen cases pathogenic bacilli were isolated between the fifth and tenth weeks after the onset of illness.

In six cases pathogenic bacilli were isolated between the eleventh and fifteenth weeks after the onset of illness.

In three cases pathogenic bacilli were isolated between the sixteenth and twenty-fifth weeks after the onset of illness.

Advantages.—The advantages of the preliminary agglutination method are: (1) efficiency, (2) simplicity, (3) speed, (4) economy.

(1) A larger number of colonies can be examined than is practicable by the ordinary methods of subculture and fermentation reactions, so that there is less likelihood of "positive" colonies escaping detection. Henderson Smith states that "there are several ways in which the experienced can save time, and increase the probability of finding any pathogenic organism present. Most important of these is the initial selection of likely colonies." At the present time, however, many of those engaged in this work are not experienced, and in their selection of three or four likely colonies in any given plate they may miss those which are pathogenic.

(2) Owing to the large amount of material which has to be examined, and the absence on foreign service of numbers of experienced workers, it has become necessary to employ unskilled assistants in many laboratories, and in the inoculation of thousands of fermentation tubes some will be contaminated; so that the results are occasionally misleading, and a pathogenic culture is discarded. This is guarded against by carrying out the preliminary agglutination tests. Qualitative agglutination on a slide is quite distinctive, even though the colony under examination be contaminated. The classification of organisms by their cultural reactions is not a simple matter which can be carried out successfully by any one who has access to a table in a text-book. The power of fermenting different sugars is more variable than the agglutinin reaction. Fraser has pointed out how difficult it is to determine from the literature the reactions of the different types of dysentery bacilli. According to Hiss and Russell their *Bacillus "Y"* ferments maltose; others say that it is to be distinguished from Flexner's

bacillus by its lack of power to do so. In the case of *B. paratyphosus* A, when it is freshly isolated, the production of gas with various sugars does not agree with that given in the tables of fermentation reactions in most text-books.

Bacilli are occasionally isolated which give the same fermentation reactions as those of the Gaertner group up to the sixth or seventh day, when they produce acid and gas in lactose. On the other hand, as Fraser has pointed out, some dysentery bacilli ferment lactose in certain media when first isolated. In the case of a carrier of *B. typhosus* in this hospital, the colonies on Endo plates prepared from the urine had red granular centres on each occasion in which the bacillus was present, though lactose was not fermented on subculture.

(3) By the adoption of the method of preliminary agglutination, it is possible to eliminate the "negative" specimens on the third day, and to arrive at a provisional diagnosis with regard to the others by the fourth day, as is shown in the following time table:—

TIME TABLE.

First Day	A	Direct plating.
	B	Inoculation of brilliant-green tube.
	C	Incubation of urine.
Second Day	D	Examination of direct plating by preliminary agglutination.
	E	Inoculation of three agar slopes from agglutinating colonies.
	F	Spreading of plates from brilliant-green tubes.
	G	Spreading of plates from incubated urine.
Third Day	H	Three agar slopes from E: (1) Titre of agglutination with high titre serum with patient's own blood serum. (2) Sugars, etc., inoculated. (3) Stored for further investigation.
	I	Examination of plating from brilliant-green and from urine. *Negative samples eliminated.*
	K	Inoculation of three agar slopes with positive colonies from I
Fourth Day	L	Three agar slopes from K examined as in H. *Provisional diagnosis of positive samples.*
	M	Examination of sugars, etc., from H (2).

Later—Confirmatory tests, such as further cultural reactions and saturation.

(4) Preliminary qualitative agglutination as a means of detecting pathogenic organisms in the excreta is economical in money as well as in time. Many sugars are difficult to obtain at present, and the price of some reagents, such as the alcohol dulcite, which costs ninety shillings an ounce, is almost prohibitive.

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A CASE OF EXPOSURE BY OPERATION OF THE INTRA-PELVIC PORTION OF THE GREAT SCIATIC NERVE.

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1916. Rifleman S., 1190, aged 23, service five years. Patient was wounded in France on November 6, 1915. He was admitted to the British Military Hospital, Brockenhurst, on November 17, 1915. Whilst in a semi-upright position he was struck by a rifle bullet on the left buttock opposite the anus one inch from the anal fold. On admission to this hospital the wound of entrance was healed. The accompanying X-ray picture, which was taken from behind looking forward, shows the bullet behind the head of the femur. He had had a certain amount of pain in the buttock, but at the time of admission was able to walk comfortably, and was not suffering any inconvenience from the presence of the bullet. When operation was suggested, he said that the bullet's location and extraction, he had been told, would be difficult, consequently he preferred to have it left alone. He was sent to an auxiliary hospital, Class "B." He returned on January 16, 1916, from this hospital and stated that after a walk of between six and eight miles he experienced a dull ache deep down behind the hip-joint. He had had this same pain on walking ever since. He also complained of some sharp stabbing pain behind the left ankle-joint, which became worse at night and in other ways suggested neuritis of the posterior tibial nerve. Another X-ray examination now showed that the position of the bullet had slightly altered. Its exact location could not be determined owing to the great thickness of the patient's thighs. The clinical symptoms made it clear that the bullet was most probably close to the left great sciatic nerve.

Operation.—January 17, 1916. Chloroform was administered by the open method by Lieutenant W. M. Jackson, R.A.M.C. The patient was placed on his right side, and the left knee was slightly flexed. The incision made was about ten inches in length. It was made one and a half inches posterior to that usually made in Kocker's modification of Langenbeck's incision for the posterior excision of the hip-joint. The gluteus maximus was split in its length, exposing the point of exit of the great sciatic nerve from the pelvis, and the muscles on which it lay. The accompanying diagram is a sketch of the structures exposed. The nerve was now carefully examined and the bullet was located inside the great sacro-sciatic foramen behind and above the pyriformis muscle. The bullet was now pressed towards the hip-joint by introducing the finger behind the sciatic nerve lying under the pyriformis muscle. The point of the bullet emerged between the pyriformis and gluteus medius muscles as shown by the x marked in the diagram. The parts near the bullet looked somewhat

Diagram of parts exposed by Kocher's model of Langenbeck's posterior incision for excision of the hip joint.

To illustrate "A Case of Exposure by Operation of the Intra-Pelvic Portion of the Great Sciatic Nerve." by Lieutenant H. E. RAWLENCE.

unhealthy, so a drainage tube was inserted. The gluteus maximus was drawn together by two catgut stitches, and the skin incision closed. The drainage tube was removed on the second day. The wound healed by first intention, and the stitches were taken out on the tenth day. Eight days later the patient was found keeping goal on the football field. He was discharged to furlough on February 21, 1916, in the best of health. The bullet was the ordinary German mauser. It was flattened on one side and was therefore probably a ricochet.

Discussion.

This man had passed through several hospitals before arriving in England, and I gather from the reports that the position of the bullet was thought to make its removal difficult. As far as I can make out in the literature the great sciatic nerve has very rarely been exposed or operated on above its exit from the pelvis. Von Baracz operated on a case of sciatica and freed adhesions at the great sacro-sciatic notch. Bardenheuer trephined the ilium and enlarged the anterior spinal foramina to relieve pressure on the roots of the great sciatic nerve. These isolated operations show that some surgeons have gained access to the nerve from behind the hip-joint. The present war has produced many new problems in surgery, and amongst them the question of access to the pelvis for the removal of foreign bodies, and also to secure posterior drainage, Before the year 1900 excision of the hip-joint was more frequently performed than it is now. Langenbeck's incision or Kocker's modification of it was used. It has the great advantage in advanced cases of disease in allowing for posterior drainage. I should like to emphasize the value of this incision. It exposes at once without any cutting or destruction of muscles the whole of the structure lying posterior to the hip-joint, including the great sciatic nerve over about four inches of its course. With very slight pressure above or below the pyriformis muscle the finger can be pushed into the pelvis, towards the front of the sacrum or forwards to the posterior surface of the acetabulum, and the interior of the pelvis can thus be explored. In this case the operation occupied twenty minutes, and though the parts exposed were at a depth of eight inches and over from the surface, the patient had no symptoms of shock, and made an uninterrupted recovery.

I have to express my thanks to Lieutenant-Colonel W. Alpin, I.M.S., for leave to publish this case, for his assistance at the operation, and in the preparation of these notes.

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Clinical and other Notes.

THE RELATIONSHIP OF VINCENT'S ANGINA TO PERIDENTAL GINGIVITIS.

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That ulcero-membranous inflammatory infections of the buccal cavity may be widely distributed on the mucous membranes of the mouth and gums, and not merely confined to the pharynx and tonsil in accordance with the classical descriptions of Vincent's angina, has been recognized by many observers since this was pointed out by Vincent himself in 1898.

In addition to an ulcero-membranous pharyngitis and tonsillitis (Vincent's angina) he described an ulcero-membranous stomatitis and an ulcero-membranous gingivitis. In all these conditions, two or more of which are not infrequently seen in the same patient, he found that the same micro-organisms were present, viz., the spirillum and *Bacillus fusiformis* of Vincent.

Although Vincent's name is usually attached to these organisms, they would appear to have been first seen and described by Miller, a German dental surgeon in 1882.

At the Queen Alexandra Military Hospital during the last few months we have bacteriologically examined nearly 300 cases of fuso-spirillary infection of the mouth, and have abundantly confirmed the previous findings of the constant presence of these organisms in all forms of ulcero-membranous inflammation of the mouth, either alone or associated with various forms of cocci, bacilli and leptothrices.

In addition to the diffuse ulcero-membranous gingivitis previously described by Vincent and others which is frequently found in association with Vincent's angina there is also frequently met with a more restricted infection of the gums with these fusiform and spirillary organisms, in which the lesions are limited to those parts of the gums which are in immediate contact with the necks of the teeth. This condition constitutes we believe a distinct clinical entity and may accurately be designated fuso-spirillary peridental or marginal gingivitis—a condition which was fully described by us in a paper read before the Odontological Section of this Society on November 27, 1916.

In addition to its prevalence this affection is of additional interest and importance in that it is often confused with pyorrhœa alveolaris, although it differs from this condition in the absence of pus and pus pockets. Further, the treatment, course and duration, and prognosis of these two affections are essentially different.

In our earlier examinations of cases of Vincent's angina the investigations were restricted to the ulcero-membranous lesions of the pharynx, and to the

differential diagnosis of the condition from other ulcerative membranous infections, particularly diphtheria and syphilis.

Later, the ulcero-membranous conditions were found not to be confined to the pharynx, and many cases of fuso-spirillary gingivitis were observed—often associated with the typical Vincent's angina.

It is, however, the restricted peridental or marginal gingivitis which we have particularly found associated with Vincent's angina, although in a few cases the accompanying gingivitis was of a more diffuse character.

Since our attention was first directed to this association of peridental gingivitis and Vincent's angina we have made a systematic examination of the gums of seventy cases of Vincent's angina, and in every case without a single exception we have found the gums to be affected, the condition in the great majority of cases being a localized peridental or marginal gingivitis. Conversely, out of 150 cases of fuso-spirillary gingivitis the characteristic lesions of Vincent's angina have been present in the pharynx or tonsil of seventy. In all these cases the clinical findings have been confirmed by careful bacteriological examination.

An investigation of the histories of these cases shows the same sequence of events in them all, namely, that the gums were always infected first, and that the sore throat was the more recent condition, having been infected, it would appear, from the gums. In many cases the patients themselves would make no complaint of the gums, but on inquiry it would be found that the gums had been sore and bled more or less freely whenever an attempt was made to use the toothbrush or clean the teeth. This condition of the gums may have been present for days, weeks, or even, in a few cases, years before infection of the tonsil or pharynx supervened.

In some of the chronic cases of peridental gingivitis the patients had repeatedly suffered from attacks of sore throat, and examination in these cases usually revealed evidences of old ulceration of the pharynx or tonsil with loss of tissue, deep crater-like depressions in these organs being often found. In this connexion the following are interesting and instructive histories:—

Case 1.—Second Lieutenant D., Lovatt's Scouts, presented himself for treatment suffering from Vincent's angina of the left tonsil. Peridental ulceration of the gums was also present about the lower incisors. The teeth were sound, clean, and in good condition. After two weeks' treatment by the topical application ot an alkaline solution of salvarsan the throat was quite healed and the condition of marginal gingivitis was much improved, though slight bleeding of the gums when touched still persisted, and fusiform bacilli were still present, though in reduced numbers. Owing to the fact that he was then recalled to his regiment no further treatment was undertaken. About the middle of November the right tonsil became sore and painful. The regimental Medical Officer applied boroglycerine, tincture of iodine, and other solutions without success, and so referred the patient back to us on December 5. We found a deep ulcer on the right tonsil, and a relapse of the peridental ulceration about the lower molars. Smears made from both the throat and gums showed the usual picture of fusiform bacilli and spirilla. Swabbing the throat and gums with salvarsan solution was again regularly undertaken and by December 18 the throat was completely healed.

On December 22 the organisms had disappeared from the alveolar margins, and there has been no recurrence either on the pharynx or the gums.

Case 2.—Pte. B., A.I.F., complained of sore throat and two deep ulcers were found on the right tonsil. A soft whitish membranous exudation covered the ulcerated surface, and could readily be removed with a throat swab or platinum loop. This slight manipulation was sufficient to excite somewhat free bleeding. The throat had been sore for two days and great pain was experienced on swallowing. The breath was very fœtid, and the lymphatic glands beneath the left angle of the lower jaw were swollen and tender. The gums also showed peridental gingivitis about all the lower incisors, and on examination it was found that bleeding of the gums had been present for the last two years. The teeth were in good order the first and second upper molars having gold fillings. Smears from both gums and throat showed the presence of fusiform bacilli and spirilla. The teeth were thoroughly cleaned by the dentist, and the gums and throat were then painted daily with salvarsan solution. By November 23 the condition of the throat was greatly improved and no bleeding occurred on instrumentation of the gums. On December 6 the throat was well and the gums were nearly healed. On December 15 the throat and gums were free from Vincent's organism.

Case 3.—Pte. C., was sent for the bacteriological investigation of a sore throat of three days duration and of bleeding sore gums of three weeks duration. The sore throat was a typical Vincent's angina, and the sore gums typical peridental gingivitis. The characteristic organisms were present in both conditions.

These few cases may be taken as examples of many which we are encountering daily, and the histories of the cases keep repeating the same sequence of events with monotonous regularity—first the bleeding sore gums which may, or may not have been diagnosed as pyorrhœa, and which may have been present for some considerable time, and then the throat becomes affected, and the typical ulcero-membranous pharyngitis and tonsillitis of Vincent's angina is seen. The diagnosis is confirmed by finding the typical organisms in both conditions.

Our experience has been confined to adults, but Vincent's angina is also seen in children, and it would be interesting to learn if the same frequency of peridental gingivitis is observed in association with Vincent's angina in children, and whether in them also the same sequence of events, viz., the peridental gingivitis preceding the Vincent's angina-occurred.

As the result of our investigations we suggest that when a patient complains of a sore throat which presents the character of Vincent's angina it is essential to examine carefully the tooth margins for evidence of peridental gingivitis or conditions diagnosed pyorrhœa, and that smears be made from both sources and examined microscopically for the detection of the causal micro-organisms. When these are found to be present the peridental gingivitis should be adequately treated as well as the Vincent's angina, otherwise the condition is likely to persist indefinitely, or to cause repeated recurrences of the sore throat.

Our thanks are due to Mr. J. Coubro Potter, Laryngologist to the Queen Alexandra Military Hospital, for sending us many of the cases and confirming our results, and to the Commanding Officer, Surgeon-General J. Dallas Edge, C.B., A.M.S., for permission to publish them.

THE TREATMENT OF STAPHYLOCOCCAL INFECTIONS BY STANNOXYL—FURUNCULOSIS AND ACNE.

(Method of Gregoire and Frouin.)

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Frouin [1], in pursuing his interesting researches on the action *in vitro* of metals, particularly the rare metals, on different bacteria, has recently been led to investigate the influence of tin and its derivatives on the growth of staphylococci. With Gregoire [2] he has established that this element, its chloride or its oxide, when added to ordinary bouillon culture medium, strongly inhibits the growth under anaerobic conditions of staphylococci; while, under aerobic conditions, the growth of staphylococci is not hindered, but the virulence of the microbe is diminished. That fact, coupled with the observation coming from the district of Beauce that *furunculosis* is an unknown affection among tin workers of the region, formed for Frouin and Gregoire the starting-point for testing *in vivo* the therapeutic value of tin in staphylococcal infections. They found that intravenous injection of the chloride or hydroxide of tin in the rabbit, twelve hours after intraperitoneal inoculation of virulent staphylococci, retarded the death of the animal by several days.

As a result of these experiments Gregoire and Frouin have given us for the treatment of lesions of staphylococcal origin the preparation stannoxyl, which is a combination of metallic tin and its oxide, entirely free from lead, a drug which, already in France [3] has given such promising results in the treatment of staphylococcal infections (*acne*, *furunculosis*, etc.).

In the present paper I propose giving an account of confirmatory results obtained by me with stannoxyl, kindly placed at my disposal by Monsieur Frouin, in the treatment of seven cases of staphylococcal infection.

These cases group themselves under the following headings:—

(1) Furunculosis.

Case 1.—Lieutenant W., aged 40. Came to see me July 16, 1917, to have a vaccine prepared for two angry-looking boils on the neck, one situated on the left side about half an inch above the collar, the other on the right side at the level of the collar. Patient was in a very excited condition, feeling, as he put it, that he was "in for a bad time." Some years previously he had had a very severe attack of boils, which at the time required drastic surgical interference, the scars from which on the neck and scalp were plainly visible. At visit on July 16, 1917, I opened and expressed pus from both boils, the culture from same giving pure growths of *Staphylococcus aureus*. Boils were swabbed with tincture of iodine, dry dressings—as recommended by Frouin—being applied, and the patient was put at once on stannoxyl internally. After two days' treatment with stannoxyl the tense feeling complained of in the neck had practically gone and the condition was greatly improved, while two days later condition had quite cleared up. No return two months later. Patient only took in all some twenty tablets (comprimes) of stannoxyl.

Case 2.—Drvr. T., aged 26. First seen by me at the laboratory on July 18, 1917, where he was sent to have autogenous vaccine prepared. Three large boils

present on neck, one in a particularly active condition, and many little boils beginning to point, besides numerous scars of old boils. Patient said that four months previously at Birmingham he suffered from a troublesome crop of boils, five of which had to be finally opened, drained and packed with antiseptic gauze before they cleared up. Treatment with a stock vaccine had then been tried and failed. Stannoxyl treatment was begun at once (July 18, 1917), the patient being recommended to take four comprimes (one gramme) per day the first day, six the second, and eight on subsequent days, while continuing the ordinary hospital treatment of boracic fomentations twice daily. On July 27, 1917, only two boils active. Injection of 250 million staphylococci (autogenous vaccine) given. A week later (July 27, 1917) boils not so active, but two tense areas amongst old scars suggestive of deep-seated pus which might point at any time; 500 million staphylococci injected (arm). Seen again August 7, 1917; condition considerably improved, patient felt better, leakage from active boils much less; tense swollen areas mentioned had become smaller, felt harder and more shotty; injection of 750 million staphylococci given. After this date vaccine treatment was discontinued, and stannoxyl, with local dressings, solely relied upon. On August 14, 1917, only two little openings from which occasional leakage of pus and lymph. Ten days later (August 24, 1917), patient practically well, only slight leakage from one little opening, all others healed. Within a week this was closed and patient apparently cured. No return of boils since. In all, some 170 comprimes of stannoxyl taken.

Case 3.—Pte. J., aged 23. First seen August 14, 1917. Boils on posterior aspect of both thighs and buttocks around cicatrices of four large "nose-cap" wounds received in France in April, 1917, from which metal had been removed. Present attack six weeks old, beginning with a boil near one of the wounds. On left buttock the remains of some thirty or forty healed boils could be counted. Had also a boil in full activity on external aspect of right elbow. Pus removed from same gave a pure culture of *Staphylococcus aureus*. About six years ago patient had a severe attack of boils "right over the face, on the arms and legs." Treatment with stannoxyl begun at once, a box of seventy comprimes being given with instructions to take eight comprimes per day, while continuing the hospital local fomentations and dressings. Seen four days later (August 18, 1917), boils on buttocks greatly improved, but a fresh crop showed evidence of breaking out in region of right elbow. Seen nine days later (August 27, 1917), the elbow condition had entirely cleared up, having apparently never come to anything, the condition on the thighs being much the same. Patient was given a second box of stannoxyl with instructions to continue taking eight comprimes per day. After this the case proceeded normally to complete cure, which was attained three days later. On September 10, 1917, there had been no return of boils. In all, about 100 comprimes of stannoxyl taken.

Case 4.—Pte. S., aged 32. Seen August 16, 1917. An active angry-looking boil situated on the outer aspect of right leg, just below the knee, from which about one cubic centimetre of pus was easily expressed. Another boil in process of healing was situated further down the same leg. Over the left knee was an inflamed area of a commencing boil, while further down same leg on anterior aspect of ankle was a boil in process of healing. Stannoxyl treatment was begun at once, the ordinary hospital carbolic fomentations every three hours not being

interfered with. Seen sixteen days later (September 1, 1917), patient was to all intents and purposes cured; there only remained a little inflammatory spot about half way down outer aspect of right leg, as if a new boil was forming. Patient said this had been so for a few days, and was told to report again if anything came of it. He never did so, hence assumed to have been completely cured. Patient had previously an attack of boils on legs fifteen years ago when in India. Quantity of stannoxyl taken—one box of seventy to eighty comprimes.

Case 5.—J. E., civilian, aged 17½. Subject more or less to boils since the age of 13. Seen September 2, 1917, patient was suffering from a boil on left side of neck about size of fairly large bean. A boracic fomentation recommended to clean and soften boil, and on September 4, 1917, a culture was made from the pus. A pure growth of staphylococci was obtained. Internal treatment with stannoxyl begun September 4, 1917, and local dressings of dry boracic lint on boil. Five days later condition had entirely cleared up and there was no evidence of fresh boils. Treatment discontinued. In all, twenty comprimes of stannoxyl taken. As drug had a marked constipating effect, only four comprimes were taken per day instead of eight, which patient had been recommended; bowels kept open with salts.

(2) Acne.

Case 6.—Pte. B., aged 21, laboratory attendant. Very troublesome acne on face since the age of 12. Condition showed weekly periodicity, in that about once a week there appeared a widespread crop of papules all over the face, eventually becoming pustular, which was most distressing. Between August, 1916, and April, 1917, patient had continuous course of treatment with autogenous vaccine (*Staphylococcus aureus*) at more or less weekly intervals, the doses ranging progressively from 50 million to 5,000 million, and that without the least benefit. Vaccine treatment was therefore abandoned, and treatment with stannoxyl begun June 23, 1917, and continued, eight comprimes per day, till August 8, 1917, during which time some 350 comprimes were taken. The condition rapidly improved with stannoxyl treatment, but between July 8, 1917, and July 14, 1917, patient visited his home in Yorkshire "on leave," and while there he had a more or less full-blown attack. On account of this, on his return I continued him on treatment much longer than appeared necessary after his condition had again cleared up. For a month after treatment was suspended on August 6, 1917; there was no return of the weekly attacks, but occasionally a papule would appear on the forehead, which quickly disappeared, the rest of the face remaining quite clear. Owing to the return of some six papules on the forehead, cheeks and neck, on September 26, 1917, patient was again put on stannoxyl, six comprimes per day. Anew there was an immediate response to treatment; inside a few days condition quite cleared up. This patient's condition being now so perfectly under control by stannoxyl treatment, it is hoped by successive courses of the drug to eventually completely cure him of his complaint. Up to the present patient has taken in all 410 comprimes, about 100 grammes of stannoxyl.

(3) Infective Dermatitis (otherwise undiagnosed).

Case 7.—Pte. D., aged 27. Seen on August 20, 1917, being sent to laboratory for the preparation of autogenous vaccine. Purplish pustular eruption on extensor and flexor aspect of forearms, on back of left hand, on the neck, and a

nodule on upper lip. Condition began six weeks ago while engaged on farm work. A Gram-negative diplococcus and a Gram-positive diphtheroid bacillus isolated on culture, but no staphylococci were found. Seen again a week later (August 27, 1917), when a fresh culture was made from eruption on flexor aspect of forearm in order to confirm above finding in regard to diphtheroid organism in view of preparing vaccine. Culture revealed presence of same diphtheroid bacillus, also of staphylococci. At this visit, in the absence of staphylococci being found in the first culture, the case was considered more suitable for autogenous vaccine, prepared with above diphtheroid organism, than for stannoxyl. However, during next few days, while vaccine was being prepared, the patient was put on treatment with stannoxyl, eight tablets per day being taken. When seen five days later (September 1, 1917), condition very much improved. Stannoxyl therefore was continued, and vaccine treatment abandoned. Patient went "on leave" from September 3, 1917, till September 10, 1917, and was not seen again by me till September 14, 1917. Then patches on forearms were quite healed, and nodule on lip gone, with new skin of a faintly purplish colour formed where latter had been, but two small fresh pustules were present on left wrist, which patient thought might develop. Not having taken any stannoxyl for four days, enough was given to him for five or six days' further treatment. Culture from pustules on wrist showed presence of staphylococci, but no diphtheroid organism found. Seen again September 21, 1917; condition cured and there has been no return since. In all, patient took some 140 tablets of stannoxyl, and during treatment he was obliged to take salts ($MgSO_4$) every other night to keep bowels open.

That stannoxyl appears, therefore, to afford a sure and efficient method of general treatment for such staphylococcal infections as *furunculosis* and *acne*, would seem to be proved by the above cases, confirming as they do the results already obtained in France by Frouin and his co-workers.

The rapidity with which, in these diseases, the infection comes under control is suggestive that, here at least, there is in the metal a curative agent at work, acting probably as in the corresponding anaerobic *in vitro* experiment of Frouin and Gregoire (*loc. cit.*), in which case it would be by producing a soil unfavourable for the growth of staphylococci. Its effect on the growth of staphylococci under aerobic conditions *in vivo* I propose shortly to deal with, in a further paper on the treatment of the "mixed infection" of *pulmonary tuberculosis* by stannoxyl.

My best thanks are due to Major Betts, A.A.M.C., Major Norris, A.A.M.C., and Captain B. Brooke, A.A.M.C., for kindly sending to me, and placing at my disposal, most of the cases dealt with in the foregoing study.

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A NOTE ON LICE AND SKIN DISEASE.

By Captain J. F. SMITH.
Royal Army Medical Corps.
Officer in Charge of Skin Department, General Hospital, France.

Attention has recently[1] been directed by Captains H. C. Semon and H. W. Barber to the importance of pediculosis as a cause of cutaneous disease in the Army. While it has always been recognized that lice can and do give rise to such conditions as impetigo and ecthyma, considerable credit is due to these authors for, firstly, showing that in the Army *Pediculus corporis* frequently deposits its ova on the pubic hair, thus defeating such anti-parasitic measures as are directed only to the clothing and blankets; and, secondly, for showing that the lesions, and still more the distribution of the lesions, are sufficiently characteristic to enable a diagnosis of pediculosis to be made, even in the absence of live parasites or ova.

The object of this brief communication is to show that the contentions of Semons and Barber are entirely borne out by the experience of another base hospital.

In the last 1,047 cases which passed through my hands there were 207 cases of scabies, and 137 cases of pediculosis, the latter in every case carrying live pediculi or ova. There were in addition 144 cases of pyodermia (ecthyma, etc.), in which the distribution of the lesions strongly suggested pediculosis, but in which no absolute evidence was found. (As a majority of my patients come via casualty clearing station it is not unreasonable to assume that for every case arriving with live parasites there is at least one who has been freed from them.)

A further point of some interest emerges. In this series of 1,047 patients there occurred fifty-one cases of "trench fever." No case in which any cause, such for example as tonsillitis, for the pyrexia could be discovered, was included, and all the fifty-one cases showed the symptoms which are recognized as characteristic of "trench fever." Forty-eight of these occurred in patients suffering either from scabies or pediculosis, an incidence of almost ten per cent, while three only occurred among all the other patients, an incidence of 0·59 per cent.

It would be unwise to draw deductions from so few cases, but the above figures certainly lend some support to the theory that trench fever is carried by lice.

Conclusions.

(1) In the British Expeditionary Force it is not exceptional for *Pediculus corporis* to lay its eggs on the pubic (and occasionally axillary and peri-anal) hair, thus defeating the anti-parasitic measures in ordinary use.

(2) Patients frequently reach the base with marked pediculosis, even after weeks' residence in casualty clearing stations.

(3) Pediculosis is almost certainly a more serious cause of disabling skin disease than scabies.

(4) There is some evidence that lice are the carriers of the infection of "trench fever."[2]

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[1] *Brit. Journ of Derm. and Syph.*, July—September, 1917, "Pyodermia of Parasitic Origin."

[2] See Interim Report, War Office T. F. Commission. Journal of the Royal Army Medical Corps, March, 1918.

NOTES OF A CASE OF PNEUMOCOCCAL PERITONITIS WITH ACUTE GASTRIC DILATATION.

By E. F. SYRETT, M.D.

AND

Captain W. L. CHRISTIE.

Royal Army Medical Corps.

(By permission of Lieutenant-Colonel J. Kearney, R.A.M.C., S.M.O., Harwich Garrison.)

The rarity of the above condition may make it worth while to record a case of the disease.

Pte. W., aged 20, Middlesex Regt., was admitted on February 12 with a temperature of 104° F., under Dr. Syrett. Pneumonia was diagnosed, first on the left and later on the right side also. The attack was severe, the temperature reaching 104° F. on February 13, 15 and 20; when the temperature fell gradually to 99° F. on the 22nd. The pulse also fell from 132 to 98. Hope was raised that patient was recovering, but vomiting of dark bilious fluid began, and at 6.30 p.m. the same day, in consultation, we found peritonitis and tympanites reaching up to the fifth rib. Obstruction was diagnosed. It was considered that patient was too weak for operation. The vomiting became more copious and urgent. At 11.45 a.m., on the 23rd, the patient died.

A post-mortem was made four hours later, and so much did the stomach fill the abdomen that at first no other organ could be seen, save the liver. The fundus pushed up to the fifth rib, and the greater curvature reached to within an inch of the pubis; the transverse colon was in the true pelvis, where the ileum lay quite empty and collapsed. The colon was contracted also. The duodenum was stretched to a diameter of 2½ to 3 inches. The duodenum-jejunal flexure was normal in size and must have been pressed on by the mesentery, for gas seemed to be entering merely from manipulation movement during examination. There were no adhesions or acute obstructions. There were, however, several flakes of lymph, yellowish-white in colour, thready and toughish as is characteristic of pneumococcal empyema. These came down on to the smaller curvature and fundus from the diaphragm. It would, therefore, appear that the stomach was paralysed by toxæmia acting on its nervous plexuses, and that distension occurred which further caused pressure on the terminal part of the duodenum.

Those practitioners who are robbed, as it were, of their pneumonia cases just as they are on the turn for recovery will naturally feel interested as to the frequency of such a condition. Messrs. Rowland and Turner, "Jacobson's Operations of Surgery," quote ninety-one cases of this rare disease—all children under 15. In thirty cases the peritonitis was secondary to a lesion elsewhere, especially in the lungs and pleura. Primary infections had occurred in the throat or ear in several cases. On gastric dilatation of stomach, Osler, in "Principles and Practice of Medicine," quotes 102 cases. Of these, forty-two followed operations with general anæsthesia. The next largest group occurs in the course of severe diseases or during convalescence. It is noteworthy also that we had an outbreak of pneumonia, sore throats and cerebrospinal meningitis going on during February, when the case occurred, and our past experience leads us to expect appendicitis with this group in the spring season.

A SIMPLE AND EFFECTIVE METHOD OF GIVING QUININE TO MALARIAL CASES IN ORDER TO PREVENT RELAPSES.

By Lieutenant-Colonel G. J. STONEY ARCHER.
Royal Army Medical Corps.

During July, 1917, I noticed that a large number of cases of malaria were returning to hospital which had previously been treated in various hospitals and discharged as cured. In order to prevent this, I determined to try a system of treatment which I had found satisfactory under similar circumstances in Burma. The line of treatment is as follows: On discharge from hospital of each case, a memorandum is sent to the officer commanding, and the medical officer in charge of the unit to which the man belongs and to which he is proceeding. This memorandum states that the man has received hospital treatment for malaria but, in order to prevent relapses, it is necessary that he should receive further out-patient treatment on the following lines, viz: To receive ten grains of quinine three times a day for three consecutive days three times a month, and in order to make it easy to remember, it is recommended that these days should be those days in the month in which 1, 2 and 3 occur, viz., 1st, 2nd, 3rd, 11th, 12th, 13th, 21st, 22nd, 23rd, and that this treatment should be continued for three months; arsenic and iron tonics being given in the intervals between the quinine treatment at the discretion of the man's medical officer. Should the man be moved from one station to another during this course of treatment, instructions are to be sent to the medical officer at the man's new station informing him of the treatment he is receiving and letting him know how long it will be necessary to continue in order that the patient may have the full course of three months.

In accordance with "Provisional Instructions for the Treatment of Cases of Malaria," the patient is now also given a bottle containing twenty five-grain tabloids of quinine, with written instructions as to how he is to take them in case of emergency if he is not within immediate reach of a medical officer.

The above treatment was started in the Cork district in the end of July, 1917, and, since its inception, the medical officer in charge of the malarial wards reports that he cannot trace a single case of a man returning with a relapse where the above treatment was carried out; and, at the present time, we have not a single malarial case in the hospital, whereas, before its adoption, there were regularly between twenty and thirty in-patients in the Central Military Hospital. Nearly all were cases which had been infected at Salonika, and, during their stay in hospital, seemed particularly resistant to treatment.

The blood of all cases suspected of suffering from malaria which occur in the Cork district is sent to the bacteriologist at the hospital for examination and report. Of such specimens which were sent during July, forty-nine on examination were found to be positive as regards the malarial parasite; during August, twenty-two; during September, eleven; during October, four; and, up to date (November 24), this month, nil.

The treatment is simple, easy to remember, involves no risk to the patient and can be carried out without any apparatus in small out-stations, and, in this respect, has advantage over the intravenous injection of quinine or salvarsan, etc.

No known treatment at present appears to be able to deal satisfactorily with

the parasite when it is as it were hibernating in the tissues, but this mode of treatment attacks it vigorously if it once comes out to go through its cycle of development. This is the second time in which I have had personal experience of satisfactory results from this method of treatment.

THE STABILITY OF AN ALKALINE HYPOCHLORITE SOLUTION.

By Second Lieutenant A. F. McCULLOCH, R.F.A., M.A., B.Sc.
Research Chemist in Bacteriology, Edinburgh University.

An alkaline hypochlorite solution has been put on the market as an efficient water sterilizer. This led me to investigate the stability of such a solution and its value as a sterilizer for use in tropical countries. The solution contained calcium hydroxide, calcium hypochlorite and sodium hypochlorite, and the average amount of available chlorine was 3·5 per cent; 0·35 per cent chlorine was present in the free state.

The available chlorine was estimated as follows: Two cubic centimetres of the solution were added to 100 cubic centimetres distilled water, 10 cubic centimetres of twenty per cent acetic acid and excess of a solution of potassium iodide (1 in 2) were then added and the iodine titrated with N/10 sodium thiosulphate and starch. The sodium thiosulphate was finely powdered and washed well with alcohol and ether and then dried. Acetic acid was used instead of hydrochloric as chlorate was found present. Hydrochloric acid breaks up chlorate, liberating chlorine. Twenty per cent acetic acid was found to have an unappreciable effect on chlorate.

The presence of the calcium hydroxide tends to keep the hypochlorite from breaking up. Water hydrolyses the hypochlorite forming hydroxide and free hypochlorous acid, which being unstable breaks up liberating chlorine:—

$$Ca(ClO)_2 + 2H_2O \rightleftarrows Ca(OH)_2 + 2HClO$$

It is evident from this reversible equation that if the hydroxide be increased, the hypochlorous acid must decrease in order to maintain equilibrium. An acid has the opposite effect. Instead of maintaining hypochlorite the acid drives the action forward, represented thus:—

$$Ca(ClO)_2 + 2HCl \rightleftarrows CaCl_2 + 2HClO$$

An interesting point thus arises. Is all the "available" chlorine liberated on dilution, and, if so, is the liberation due to dilution or to the carbonic acid in the water?

Effect of Increase in Temperature.

Two ground-glass stoppered bottles A and B were filled with the solution, one of which, B, was waxed over and stopper tied down.

Examined December 28, 1916:

Available chlorine .. .. .. 3·67 per cent

Put into thermostat at 37° C. (99° F.), 12 noon, December 30, 1916.

Examined Bottle A at 12 noon, January 2, 1917, after three days:

Available chlorine .. .. .. 3·67 per cent

Examined Bottle A at 12 noon, January 6, 1917, after seven days:

Available chlorine .. .. .. 3·55 per cent

Examined Bottle A at 12 noon, January 13, 1917, after fourteen days :
Available chlorine .. .. .. 3·41 per cent
Examined Bottle A at 12 noon, January 21, 1917, after twenty-two days :
Available chlorine .. .. .. 3·31 per cent
Examined Bottle A at 12 noon, February 23, 1917, after fifty-five days :
Available chlorine .. .. .. 0·80 per cent
Examined Bottle B at 12 noon, February 23, 1917, after fifty-five days :
Available chlorine .. .. .. 0·88 per cent

Two ground-glass stoppered bottles, A and B, were filled with the solution, one of which, B, was waxed over and stopper tied down.

Examined January 16, 1917 :
Available chlorine .. .. .. 3·60 per cent
Put into thermostat at 50° C. (120° F.), 12 noon, January 16, 1917.
Examined Bottle A at 12 noon, January 18, 1917, after two days :
Available chlorine .. .. .. 3·38 per cent
Examined Bottle A at 12 noon, January 21, 1917, after five days :
Available chlorine .. .. .. 3·25 per cent
Examined Bottle A at 12 noon, February 23, 1917, after thirty-eight days :
Available chlorine .. .. .. 1·50 per cent
Examined Bottle B at 12 noon, February 23, 1917, after thirty-eight days :
Available chlorine .. .. .. 1·52 per cent

Effect of Sunlight on the Solution.

Samples were put up in various coloured bottles, exposed to the direct rays of the sun for four or five hours per day, and to diffused light during the remainder of the day.

(1) Clear ground-glass stoppered bottle. Cork tied down and covered with collodion. After a few minutes' exposure to sunlight bubbles commenced to rise in the liquid and continued to do so as long as the bottle was exposed to direct sunlight.

Available chlorine before exposure to sunlight 3·67 per cent
Exposed to sunlight at 12 noon, January 3, 1917.
Examined noon, January 6, 1917 :
Available chlorine .. .. .. 2·49 per cent
Examined noon, January 13, 1917 :
Available chlorine .. .. .. 1·17 per cent

(2) Light blue coloured bottle. Same phenomenon observed as with clear glass bottle.

Available chlorine before exposure to sunlight 3·67 per cent
Exposed to sunlight at 12 noon, January 6, 1917.
Examined noon, January 15, 1917 :
Available chlorine .. .. .. 1·81 per cent

(3) Light brown-coloured bottle. No gas evolution observed.

Available chlorine before exposure to sunlight 3·62 per cent
Exposed to sunlight at noon, January 10, 1917.
Examined noon, January 15, 1917 :
Available chlorine .. .. .. 3·43 per cent

(4) Dark green-coloured bottle as sent out by firm. No gas evolution observed, but numerous gas bubbles formed gradually on inner walls of bottle.

Available chlorine before exposure to sunlight 3·15 per cent

Exposed to sunlight at noon, January 10, 1917.
Examined noon, January 15, 1917:

Available chlorine .. .. .. 3·00 per cent

The effect of sunlight on the solution is thus the same as on a solution of bleaching powder. A solution of bleaching powder kept in the dark for several weeks suffers little less in the amount of its available chlorine but deteriorates rapidly on exposure to sunlight in clear glass vessels.

Amount of Chlorine liberated on Dilution with Distilled Water.

The carbonic acid in the water was estimated by titration with N/200 sodium carbonate and phenolphthalein, except where the carbonic acid was present in large amounts, when N/20 was used. The chlorine was estimated by adding potassium iodide solution and titrating with N/500 sodium thiosulphate and starch. The dilute solution of sodium thiosulphate was found to work quite satisfactorily, although the end point with starch was not very well defined.

Titre N/10 sodium thiosulphate of two cubic centimetres of solution diluted and acidified, i.e., titre representing total available chlorine is 2 to 16·48 cubic centimetres.

Dilution. 1 c.c. of solution in	Titre per 100 c.c. water of N/200 sodium carbonate	Titre N/10 sodium thiosulphate of 2 c.c. solution	Titre N/10 sodium thiosulphate after forty-eight hours
0 ..	1·30 c.c. ..	0·15 c.c. ..	..
50 ..	1·30 ,, ..	4·00 ,, ..	4·00 c.c.
250 ..	1·30 ,, ..	5·45 ,, ..	5·40 ,,
500 ..	1·30 ,, ..	6·50 ,, ..	6·55 ,,
1,000 ..	1·30 ,, ..	6·45 ,, ..	6·50 ,,
1,500 ..	1·30 ,, ..	6·72 ,, ..	6·80 ,,
3,000 ..	1·30 ,, ..	7·10 ,, ..	7·15 ,,
15,000 ..	2·25 ,, ..	6·95 ,, ..	..

A dilution of one cubic centimetre in 15,000 of water is equivalent to one part of chlorine to 430,000 of water.

Amount of Chlorine liberated on Dilution with Distilled Water containing Carbonic Acid.

Dilution. 1 c.c. of solution in	Titre N/200 sodium carbonate per 100 c.c. water	Titre N/10 sodium thiosulphate per 2 c.c. of solution
50 ..	11·00 c.c. ..	4·72 c.c.
250 ..	11·00 ,, ..	6·25 ,,
500 ..	11·00 ,, ..	6·85 ,,
1,000 ..	7·50 ,, ..	6·76 ,,
1,500 ..	7·50 ,, ..	6·96 ,,
3,000 ..	6·90 ,, ..	10·90 ,,
3,000 ..	80·20 ,, ..	16·40 ,,
15,000 ..	14·47 ,, ..	10·45 ,,
15,000 ..	24·88 ,, ..	12·90 ,,
15,000 ..	33·00 ,, ..	15·98 ,,

Amount of Carbonic Acid in Natural Waters.

Sample	Titre N/200 sodium carbonate per 100 c.c. water
Cannamore Water Supply. No. 1 Well ..	.. 11·80 c.c.
Cannamore Water Supply. No. 2 Well ..	.. 10·20 ,,
Adigaratti Well Water	.. 11·97 ,,
Adigaratti Spring Water	.. 4·10 ,,
Madras Water Supply. No. 1 Tank	.. 2·90 ,,
Madras Water Supply. No. 2 Tank	.. 12·64 ,,
Chevayor Well Water	.. 11·50 ,,
Tap Water, Laboratory, Wellington	.. 2·25 ,,

From these experiments it is evident that this alkaline solution of hypochlorite is not much more stable than bleaching powder, and is of little use as a stable sterilizer in tropical countries. The amount of chlorine liberated depends on the acidity of the water, and in no case of the water samples examined was the amount necessary to liberate all the available chlorine found to be present.

I am deeply indebted to Major W. W. Browne, R.A.M.C., Officer Commanding Enteric Convalescent Depot, Wellington, and to Major G. S. Wallace, R.A.M.C., D.A.D.M.S. (Sanitary), Secunderabad Division, for permission to do the above work in the Divisional Laboratory, Wellington, India, during my convalescence.

Lecture.

CLINICAL AND PATHOLOGICAL CO-OPERATION.[1]

By Captain P. H. BAHR,
Royal Army Medical Corps.

The subject for discussion to-night is undoubtedly a controversial one and, though there is a natural tendency for laboratory workers to be dogmatic on subjects to which they have devoted particular attention, yet I will endeavour to be as little didactic as is possible. The title I have chosen for this paper is one, which interpreted to its widest sense, is of vital interest to us all; by that I mean the collaboration between the clinician and the pathologist so as to arrive at a sure and as speedy a diagnosis as possible, one which will not only be of benefit to the patient, but also to the Army and, ultimately of course, to the country which we serve. I think one can say that there has been on the whole too great a tendency in the past for the clinician and the pathologist to work in watertight compartments and, in certain quarters, a tendency on the part of the clinician to rely too much upon a pathological diagnosis which is perhaps unsupportable by clinical data and which a short consultation in the wards or in the laboratory would soon have adjusted.

I would like to see the clinician much more often in the laboratory and the pathologist in the wards, both acting in a consultative capacity, and I would like to see it established as a rule that a pathological diagnosis which does not agree with the clinical signs should be regarded every bit as unsatisfactory as a clinical diagnosis which does not tally with the pathological report.

To quote Emerson in the preface to his well-known "Clinical Diagnosis," he says: "The function of the clinical laboratory worker is to aid the ward worker. The findings of the former are seldom conclusive and must be interpreted in the light of the ward findings; especially is this true now that functional diagnosis is the goal. . . . . The clinical chemist must first be a good clinician and secondly a chemist; he should remember that, even from a laboratory point of view, his

[1] An address delivered before the Cairo and Delta District Medical Society on December 15, 1916.

stethoscope is of more importance than the microscope, his percussion finger than the whole outfit of chemical apparatus."

The modern pathologist cannot afford to disregard clinical phenomena. I will now give you a few details of what I mean based upon my experience as pathologist and clinician during the last two years of military practice as well as upon a varied tropical experience during the last seven years.

I have long been of the conviction that an intimate knowledge of Tropical Medicine is almost essential to every clinician and pathologist practising in the East, and I look forward to the day when a knowledge of what is now a speciality may become part of the ordinary medical curriculum. Now the essence of Tropical Medicine is a study of the blood, and if possible, it is a still higher factor here in Egypt, situated as this country is in a zone common to diseases of temperate and those peculiar to tropical climates.

I shall deal first with the aid which can be derived from a simple blood examination of the pyrexias of this country. Firstly it is advisable to examine the blood for the malarial parasite in every case of fever. The discovery of this parasite in an ordinary Leishman-stained film is an easy matter, and such a film should be examined in every case. This is of vital importance, because it is the only fever for which we possess an absolutely specific drug in quinine.

There is an idea abroad that the malaria parasite can only be found in the peripheral blood during a short period immediately preceding and following the malarial rigor. This I might say is a complete fallacy as regards the benign forms of malaria—the benign tertian, which is extremely common, and the quartan, which seems to be an extremely rare parasite in this country.

As regards the malignant or sub-tertian parasite the case assumes an entirely different and much more serious complexion. I would like to remind you that only the youngest and the most mature (i.e., the ring and the crescent) forms of this parasite are found normally in the peripheral blood. The rest of the cycle, of which specimens have been exhibited for your inspection to-night, takes place in the internal organs—such as the brain, spleen, bone-marrow, pancreas and intestinal capillaries. From the blood stasis thus produced in a non-immune subject the most serious symptoms, dangerous to life itself, may be suddenly produced. The symptoms elicited vary according to the organ attacked—thus we may get hyperpyrexia, this is often named heat-stroke ; coma ; the so-called sun-stroke of West Africa and other tropical countries ; conditions resembling appendicitis, cholera, intestinal obstruction, rheumatism, acute nephritis, pernicious anæmia, malignant jaundice (often misnamed yellow fever, the bilious remittent fever of the tropics) or it may even produce blackwater fever itself. All these conditions can be promptly cured with an early and efficient dose of quinine. It is therefore of the utmost importance to examine the blood at the earliest possible moment. But may I beg you not to do as often as has been done in the past, when treating with such suddenly developed and calamitous symptoms, to await a pathological diagnosis, which cannot be rapidly obtained, before exhibiting quinine, but rather to take a blood-smear and forward it to the nearest laboratory, immediately after examining the patient, and then to administer quinine before awaiting the result, which might take days to arrive. If this practice were invariably conformed to, I should be unable to exhibit some of

the microscopical post-mortem specimens you will see to-night. An intelligent appreciation of the life-history of this parasite will soon convince you that in the majority of cases of fresh infections the parasite may not be present in the peripheral blood for thirty-six hours or more from the commencement of the attack, and before that period has elapsed some patients may be dead or in too serious a condition for the quinine to act. It is therefore important to give quinine immediately in all cases exhibiting serious symptoms of this sort, in whom either a pathological diagnosis cannot be obtained or in whom such diagnosis is unsatisfactory from a clinical point of view. You may take it as a general rule from experience gained on the canal zone, as well as elsewhere, that a pyrexia followed by a rigor occurring in a malarious district during the forenoon or early afternoon is almost invariably of malarial origin, and it is necessary to bear in mind, as a corollary of this statement, that cases of malignant malaria may and do occur without any pronounced pyrexia at all—the so-called algide forms. I would once more remind you that, though the benign forms may be trivial and do not warrant the invaliding of an individual, the malignant form is a different matter altogether.

The diagnosis of relapsing fever is generally an easy matter, as the temperature chart is so typical and the spirochæte is so easily found in a properly stained film (carbol fuchsin being the best stain), but it is necessary to keep in mind that the spirochæte very frequently disappears from the blood-stream about forty-eight hours before the crisis, and, unless this fact is recognised, many cases which would otherwise be diagnosed on clinical grounds as relapsing fever will be missed for want of a pathological confirmation.

As regards the procedure to secure a diagnosis in cases of pyrexia in which the malarial parasite or the spirochæte cannot be found, we can obtain a great deal of information, if not a probable diagnosis, from the correlation of the temperature chart together with a total and a differential leucocyte count. I should like to impress upon you that one without the other is useless, and that, in order to obtain the necessary accurate information, the films for the differential count should be made in a particular way, and that they should be stained with hæmatoxylin and eosin. I find that any other stain gives, owing to specific reactions for glycogenic granules, etc., a totally erroneous idea of the due proportions of the different varieties of white cells present in the film. At least a total of 300 cells should be counted and a considerable practice in this procedure is necessary. A leucopenia of 2,000 to 3,000 whites with a high mononuclear count, i.e., from fifteen per cent upwards (by the large mononuclear cell I mean the large hyaline cell with kidney-shaped or elongated nucleus of text-books) strongly indicates a persistent protozoal infection, such as malaria, leishmaniasis or trypanosomiasis. The latter two diseases of course are of infrequent or of extremely rare occurrence in this country, but may presumably occur from time to time in troops hailing either from the Sudan or East Africa. Now, a continued pyrexia which does not respond to quinine together with a reduction in the number of red cells with a differential leucocyte count such as I have described ought to lead the clinician to puncture the spleen or liver for the Leishman-Donovan body and the pathologist to make a long-continued search of the blood for the trypanosome. A leucocytosis, on the other hand, with an actual increase of the polymorphonuclears over seventy-five per cent in a patient with a continuous nocturnal

pyrexia of a septic type together with a peculiar pallor of the facies and, it may be, with symptoms of a right pleurisy, strongly suggests the probable diagnosis of liver abscess. Such a patient may or may not have given a history of a previous dysentery with the presence of the *Entamœba histolytica* or its cysts in the stools. In cases of this nature the therapeutic test alone—i.e., the strenuous exhibition of emetine both orally and intramuscularly administered—will alone decide the diagnosis. And I am glad to say many favourable results have latterly been recorded as a result of this procedure. At all events, in amœbiasis of the liver or of the gut it is absolutely necessary in the interests of the patient to act energetically and promptly without a moment's hesitation.

Now a slight rise in the mononuclear count, together with a decided leucopenia occurring on the third or fourth day of the pyrexia, if associated with typical clinical phenomena such as a bradycardia, is characteristic of three tropical fevers—yellow fever, dengue and phlebotomus fever. The latter two of course are commonly met with in this country, and the subsequent course of the fever will naturally decide the diagnosis. As far as I know there is no blood change peculiar to seven-day fever. The saddle-backed character of the chart alone can render the diagnosis in this case.

The season of the year at which these fevers occur is of importance, phlebotomus fever occurring either in the early summer—i.e., June or in the autumn (the latter part of August and September), when the insect transmitter is most abundant, while dengue generally only occurs during the hottest part of the year—i.e., July and early August, though epidemics have been exceptionally recorded in October. High atmospheric temperature appears to be one of the conditions it demands, and when perhaps the breeding season of *Culex fatigans*, the transmitting mosquito, is at its height. Unfortunately for diagnosis, the blood-picture of undulant fever or Malta fever is in no way characteristic. But a continued diurnal and persistent lymphocytosis (i.e., a rise above thirty per cent) may be taken as indicating that the pyrexia is of tubercular origin. An eosinophilia of over five per cent without a leucocytosis in this country is almost diagnostic of some helminthic infection such as the ascaris or the ankylostome or the urinary bilharzia. But a high eosinophilia of twenty to thirty per cent or over, together with a total leucocytosis of 10,000 to 15,000 white cells, in a patient with anæmia, emaciation, enlarged liver, tenderness over the gall-bladder and often urticaria as well, should lead the pathologist to search long and on several occasions with a low-powered lense for the ova of the rectal bilharzia. There is no doubt that these cases—a chart of one of which has been exhibited this afternoon—suggest at first sight enterica. Rectal bilharzia (*B. mansoni*) then, which is occurring among the troops in Egypt, produces a systemic disease identical in its clinical features with "Katayama disease," due to the allied *Schistosomum japonicum* in Japan. This is an entirely new clinical fact, and the credit of the discovery belongs to the staff of the Third Australian General Hospital. On the other hand the urinary bilharzia appears to produce no such marked systemic disturbance and only a slight eosinophilia.

I next propose to deal shortly with the serum diagnosis of enterica and Malta or undulant fever. At the outset I might say that my statements are based entirely on the readings obtained by Captain Garrow's agglutinometer, from which

I venture to say results of very great military importance have been obtained. With reference to the diagnosis of enterica we learn that :—

(1) Any reading of a titre under 1 in 320 in a person who has been inoculated within the past year with a vaccine of enterica—"T." or "B."—must be disregarded as of any diagnostic importance.

(2) The residual agglutination titre remains at this figure for a year or more.

(3) The "A." agglutinins do not persist to anything like the same extent as the other two, and it is rare to find a case with an agglutination titre to "A" of over 1 in 40 six months after a "T.A.B." inoculation.

The value of a serum diagnosis is still unimpaired in cases in whom a blood culture cannot be obtained or in which it is too late to obtain it. Supposing then the titre either to "T.," "A." or "B." be found to rise after repeated Widal tests from the ninth to the sixteenth day of the disease the case may be justly regarded as of being that particular infection.

Blood culture still remains the most certain means of diagnosis in enterica, but apparently this can only be expected in not more than 30 per cent of cases in hospital practice. Personally I place considerable reliance on a positive result of urine culture as indicating the particular infection from which the patient suffered. But it is otherwise I think in the case of stool cultures, for instances have occurred in which a certain bacillus, say para. B, has been obtained from the stool in cases which certainly suffered originally from para. "A" septicæmia, the former bacillus having presumably previously existed in the intestinal canal as a saprophyte.

The serum diagnosis of Malta and para.-Malta fever presents certain characteristics which recent experience has verified. Firstly, the agglutinins appear in the blood only after a considerable period of pyrexia, say three weeks or more, and then a positive agglutination may occur only in a low dilution of 1 in 10 or 1 in 40. Secondly, in cases with a high agglutinin serum-content a marked inhibition zone occurs : that is, the serum, owing apparently to the presence of anti-agglutinins, may not agglutinate the specific organism in lower dilutions than 1 in 160, but may strongly agglutinate the organism from that figure upwards. As regards the clinical aspect of Malta fever in this country, the temperature charts are by no means always typical, and I have recently seen a series of cases of para.-Malta fever which resembled closely those of miliary tuberculosis, but it has been pointed out that a persistent maximum rise of temperature daily at 2 p.m. is nearly always in itself diagnostic of Malta fever. I think we should remember then that para.-Malta fever is not of infrequent occurrence in this country and that in its serum reactions the *paramelitensis coccus* is quite distinct from the original *melitensis* strain.

The diagnosis of dysentery exhibits in the closest possible manner the point I wish to emphasize to-night, for it demands, more than any other, the closest co-operation between the physician and the pathologist. It is necessary to bear in mind that the specific cause of the commonest forms of dysentery in this country —the entamœba and the dysentery bacillus are both delicate organisms and die out in a very short time after the stool has been passed ; therefore a microscopic examination of a stool specimen which has stood for four hours or more can be of no value whatever ; the amœba will be dead and therefore non-motile ; and I hold that this is impossible for the most practised microscopist to differentiate in this state between the dead amœba, and any other dead and disintegrating cell, such as

are found in such numbers in any dysentery stool. In freshly passed stools living and active amœbæ containing ingested red cells should be passed in 90 per cent of all amœbic cases, and the diagnosis thus becomes an easy matter, and I think that Lieutenant-Colonel Wenyon's rule, that any active amœba with ingested red cells in a dysentery stool should be regarded as the *Entamœba histolytica*, is an extremely sound one to follow.

It is highly necessary that the clinician himself, in order to bring about this utopian state of affairs, should inspect all dysentery stools himself, but more especially those he sends to the laboratory for diagnosis. In any case—whether amœbic or not—it is useless to send fæculent stools when the patient may be from time to time passing ones consisting almost entirely of blood and mucus, for in both diseases the specific cause is found only in the pathological exudate and not in the fæces themselves. One ought to bear in mind that a class of diarrhœas of amœbic origin does undoubtedly exist in which the amœbæ are only intermittently excreted and these account for the remaining cases in which the specific cause cannot be found during the first microscopic examination. Therefore should the clinician be satisfied that from his own point of view the pathological report is unsatisfactory, he should not rest content with the result of a single microscopical examination of his patient's stool.

I think from what I have told you, that you will bear me out that by itself the diagnosis of dysentery constitutes the strongest plea for the decentralization of simple laboratory work such as has been attempted latterly here in Cairo, and that every hospital in the tropics should have its own laboratory, however small, for the diagnosis of these conditions on *the spot*.

The question arises whether it is possible to differentiate between the dysenteries on the macroscopic appearances of the stool. I think it is by no means always possible to do so, but as a general rule the amœbic stool contains small clots of mucus, together with small clots of blood intimately mingled with the fæcal contents, thus giving the appearance of "anchovy sauce." I must apologize for the very disagreeable habit, peculiar to our profession, of comparing pathological exudates to articles of diet, but naturally their exact appearance depends, as indeed also in the bacillary form, on the situation, condition, and extent of the lesions; on the other hand, the stools passed in the early stages of bacillary dysentery resemble nothing more than red-currant jelly, or sometimes frog's spawn, while in the more advanced stages they have been compared to meat washings, due to the hæmolysis of the red cells and the consequent diffusion of the hæmoglobin and its decomposition products into the surrounding mucus.

In the microscopical examination I lay great stress on the cell exudate, as not only differentiating the two forms, but as also indicating the stage of the disease and the ultimate progress of the patient. Briefly then the presence of a number of macrophage cells—that is a large hyaline cell twenty to thirty microns in diameter, containing chromatic bodies and often red cells as well, but with no very definite structure—together with a large portion of pus cells, relatively few red cells, and few visible bacilli, indicates a bacillary infection and suggests a suitable stool for culture. These macrophage cells I have just mentioned are very important, as they have often been mistaken by the uninitiated in the past for amœbæ, and being derived, as I have good reason to believe, from the submucosa, their continued presence in the stool is of favourable import as indicating that the

repair of the tissues is taking place. On the other hand, bile-stained disintegrating pus cells and the intestinal epithelium, together with numerous bacilli in the microscopic field, denote that an extensive necrosis of the mucosa has taken place. Such a stool is quite unsuitable for culture and in many such cases I have been able to obtain a culture of the dysentery bacillus from the mucus membrane post mortem when I was quite unable to do so from the stool during life. The failure, then, to obtain the specific bacillus from the stool during life does not invariably mean that the case is not one of bacillary origin. Under the circumstances it seems to me a waste of time and material to demand, as has been done, two negative examinations of the stools of a patient convalescent from bacillary dysentery before his discharge from hospital. This is a most tedious practice and endeavours to find the specific dysentery bacillus in a fæculent stool are rarely, if ever, successful.

I sincerely think that this practice ought to be discontinued as tending to keep patients in hospital longer than necessary and as being a quite unpractical procedure. It is like looking for a pin in a haystack.

The culture of the dysentery stool presents certain peculiarities and it is impossible even with a pure blood and mucus stool and the most improved technique to render a definite report before forty-eight hours have elapsed from the time of the dispatch of the specimen to the laboratory.

I think it is quite permissible for the pathologist under these circumstances, in order to facilitate early specific treatment in the interests of the patient, which is really all that is required in practice, to suggest a diagnosis on his microscopical findings of the stool alone, and he will, according to my experience, be right in nearly every case ; he then can render a finished report at his leisure.

The bilharzia dysentery stool had characteristics of its own—that is, the mucus is of a gelatinous nature and of a yellow colour, containing clots of dark blood in which the characteristic ova are present in large numbers. The pathologist ought to be warned of the clinician's suspicions as to the diagnosis of this condition, as bilharzia ova are searched for under a low-power lens and would certainly be missed with a higher magnification.

I think one must admit that there exists a distinct clinical entity, "lamblia dysentery"—due to the presence, adhering to the intestinal epithelium of the small gut, of large numbers of lamblia.

The stools in the acute stage of this disease consist of green bile-stained tenacious mucus and may sometimes contain a little blood as well. Such patients even in the acute stage are not really seriously ill. None of them appear to be very emaciated, and as the lamblia is an extremely common protozoal commensal parasite among tropical natives, and as these people by long association appear to become tolerant of it, I do not see why the troops in this country should not do the same, and personally I do think that a fetish is now being made of the presence of a few lamblia cysts in an otherwise perfectly normal healthy stool. Why should these entitle a strong, lusty, and apparently healthy man to be permanently invalided when directly he becomes tolerant of the parasite he may be of real service in the field?

Nearly all the vital diagnostic pathological work which I have recounted to you can be done with a very simple apparatus, the use of a few stains, slides and

a travelling microscope. In fact such a portable laboratory can be contained in a small case, such as one which has been my constant companion for years past.

Finally, gentlemen, I hope you will see that in order to satisfy all claims in Egypt one requires to be a clinician, to have a knowledge of tropical medicine, and I am not quite sure, in order to fully appreciate the needs of the Service and one's combatant fellow-officers, to have been a regimental M.O. as well.

Reviews.

SYPHILIS AND THE ARMY. By G. Thibierge, Surgeon to the St. Louis Hospital. Edited by G. F. Marshall, M.D., F.R.C.S. University of London Press. Pp. 210. Price 6s.

The management of venereal diseases amongst the troops of a huge army such as one of those now operating in the present War is a problem which is complicated by many novel factors. Considerations of man-power wastage, for example, make it necessary to strike a right balance between the claims of treatment and military necessities. How far the former must be subordinated to the latter is largely a matter of individual opinion guided by experience, and the book under review is interesting as an exposition of the views of an eminent French syphilologist with regard to the syphilis problem in the French Army. It will be particularly interesting to those who are acquainted with the manner in which the same problem is treated in our own Army.

In common with all who have studied the subject, the author is alarmed at the outlook for his country if syphilis is to continue uncombated by energetic measures. Calculating that the infection of each mobilized soldier or munition worker will mean the loss of one mother of a family and one soldier in the decennial period 1936-45, he estimates that the infections during the War will cost France 400,000 soldiers in that period, or the equivalent of two military classes. His analysis of the sources of infection reveals, as in this country, the important part which is being played by "amateurs" of all classes. He is greatly struck by the number of women infected by their husbands and of lads between 16 and 18 who have contracted syphilis. The prospect outlined by the author is anything but cheerful, but will be useful if it serves its purpose of rousing the country to a true idea of the problem as one of urgent national importance.

Dealing with the diagnosis and treatment of syphilis, the author is mainly concerned with the earlier stages of syphilis, since the tertiary affect the Army very little. For the diagnosis of primary syphilis he lays stress on the importance of microscopic examination and describes the dark-ground illumination as well as a number of staining methods of demonstrating the *Treponema pallidum*. In some instances the instructions are not very precise; one could wish, for instance, for more details regarding the preparation of the ammoniacal solution of silver nitrate used in Fontana's stain and as to the method of dark-ground illumination, particularly as the former is such a popular method of staining and the latter the method of choice for the demonstration of the *Spirochæta pallida*. In describing methods of obtaining the material no mention is made of the very simple technique of gland puncture when the sore has healed or has been treated with antiseptics, though the author mentions the taking of material for sections from the chancre in such difficult cases. Apparently in France, as in this country, the

syphilologist is troubled by the practice of others of relying primarily on the Wassermann test for the diagnosis of primary syphilis, and Dr. Thibierge rightly emphasizes its fallacies in this stage. He has evidently little opinion of the Wassermann test in any stage, however, and one wonders by what method his specimens have been tested to justify such strictures as he employs regarding it.

With regard to the treatment of syphilis, the author evidently subordinates everything to military considerations. The patient is treated with novarsenobenzol, given intravenously in concentrated solution (two cubic centimetres) until lesions have healed. This usually takes about three weeks. Twelve intravenous injections of the cyanide of mercury are given in the same period, and the patient is then discharged to duty with instructions to take mercurial pills for some years. In cases where the soldier's duties permit, the pill treatment is supplemented from time to time by further injections of novarsenobenzol. The author evidently has faith in the soldier continuing his treatment by pills, though in an earlier part of the book he complains of the carelessness of patients with regard to the continuance of treatment after their lesions have healed.

As to administrative details and preventive measures, the author considers that special centres for the treatment are desirable and would place these as near to the soldier's unit as possible. Apparently these hospitals came into use in September, 1916, for non-commissioned ranks but not for officers. Regarding the latter, the author seems to think it would be difficult to carry acceptance of a rule that all officers suffering from venereal disease should be sent to hospital. Definite prophylaxis is recommended, with supervision of women and compulsory treatment of the latter when necessary.

A System of Hand and Finger Re-education. By Captain C. W. Sewell. London: Baillière, Tindall and Cox. Pp. 6. Price 6s. net.

The re-establishment of the finer movements of the fingers following gun-shot wounds of the upper limb is a subject that is neglected only too frequently. This manual indicates methods by which the necessary digital exercises may be applied, and at the same time secure interest and initiative on the part of the patient. The system consists in the spanning of the "rungs" of a ladder placed at varying intervals apart, tracing different patterns with different fingers, and the building of models with small wooden blocks.

The methods described might with advantage be employed in the later stages of the treatment of injuries involving the ulnar and median nerves, when voluntary movement is returning to the affected muscles, as well as in the various disabilities brought about by disuse.

Electro-Therapeutics for Military Hospitals. By Wilfred Garton, M.R.C.S., L.R.C.P., Temporary Captain, Royal Army Medical Corps. London: H. K. Lewis and Co., Ltd.

The various disabilities caused by war service have served to draw more attention than formerly to treatment by means of electrical methods. This small volume is intended to serve as a guide for use in smaller military hospitals as well as to obtain further recognition of the value of electrical treatment. The subject of electro-therapeutics, however, is relatively large and one to which it is not possible adequately to do justice within the limits of a small book.

The author furnishes a description of simple apparatus procurable at a small cost, which serves for the treatment of those cases most frequently met with.

In a chapter dealing with the paralysis of muscles, the statement appears that "if the affected muscles contract readily to a faradic current and react normally or almost normally to a galvanic current, then the injury to the nerve is slight and there is probably no structural damage. The condition is similar to a pressure palsy and recovery may be almost immediate and should certainly take

place under three months." No mention is made, however, of hysterical paralyses which are by no means infrequently encountered following gun-shot wounds, and to which the above statement regarding the electrical reactions would equally apply. From the point of view of treatment, the importance of recognizing such conditions cannot be over-estimated, as the longer they are allowed to persist the more difficult is ultimate cure. Further, the writer at times is rather inclined to sacrifice accuracy to brevity, for instance, the observation that "when a nerve is completely divided the faradic current (*sic*) in the muscles supplied by that nerve disappears in a day or two" is scarcely correct.

For ionization, the use of long pads stretching the whole length of the limb is recommended. To state, however, that in neuritis affecting a nerve trunk, "ionization is the only method of treatment worth consideration," is to ignore the most important fact of ascertaining what underlying cause or focus of infection is responsible for the appearance of neuritis, and taking steps to eliminate it.

Good results are claimed for cerebrospinal galvanism in the treatment of patients suffering from "shell shock" and neurasthenia; the manner in which it acts, however, is not suggested. In a later chapter some useful practical hints are given regarding the use of zinc ions for ulcers and sinuses.

THE "NAUHEIM" TREATMENT OF DISEASES OF THE HEART AND CIRCULATION IN ENGLAND. By Leslie Thorne Thorne. Fifth Edition, 1918. Pp. vi + 160, $7\frac{1}{4} \times 4\frac{1}{2}$. Published by Baillière, Tindall and Cox.

The reviewer happens to have studied this method of treatment in Nauheim. He can, without adverse racial prejudice, testify to the fact that, as expounded and practised by Dr. Thorne, the "Nauheim treatment" can be carried out in the British Isles in every detail, and not less efficaciously, than in the town which gives it its name. In this connexion, doctors have only to be careful to recognize that much of the benefit of Nauheim itself is attributable to its healthy situation and to its distance from the sources of worry and strain for British visitors.

In this little book, Dr. Thorne proves convincingly that he has completely mastered this important method of treatment. He honestly and unselfishly gives abundant help to such of his professional brethren as may be undertaking the practice of his methods. Full details are invariably given, and many little "tips" that can only have been culled from very wide experience in the practical application of the treatment and the selection of suitable cases. The exemplary cases that are given as brilliant little clinical pictures speak for themselves. It is very pleasing to see that Dr. Thorne gives his readers the opportunity of interpreting his cardiograph tracings independently in that he shows most of them from their commencement, and not, as has become a misleading fashion, a small section carefully selected and lettered to suit a particular purpose. It is to be regretted that the chapter given to the controversial subject of "Soldier's Heart" is so slender, considering its importance. However, as in all the chapters, some excellent practical points are emphasized, e.g., the importance of avoiding too long rest for the heart's sake alone. Insufficient stress is laid upon the mental factor in "Soldier's Heart": on the other hand, the author evidently believes that sinus arrhythmia plays an important rôle in this symptom-complex, for he seems to have found it more marked and more constant than have others of wide experience.

No practical physician who wishes to keep conversant with modern cardiology can afford to leave this book unread, even in these pressing times. R. T. S.

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Corps News.

May, 1918.

War Office,
April 6, 1918.

With reference to the awards conferred as announced in the *London Gazette*, dated November 26, 1917, the following are the statements of service for which the decorations were conferred :—

AWARDED A BAR TO THE DISTINGUISHED SERVICE ORDER.

Major (Temp. Lieut.-Col.) Patrick John Hanafin, D.S.O., Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty. For nine days he was continuously under heavy shell fire while supervising the evacuation of the wounded in the most adverse circumstances. Finally, although wounded in passing through a heavy barrage, he continued on duty until the last man had been brought in. The successful evacuation of the wounded was largely due to his gallant conduct.

Temp. Capt. Robert McCowan Hill, D.S.O., M.B., Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty. While on the way to battalion headquarters, his party was caught in an enemy barrage, and four of them were wounded. He at once dressed their wounds on the spot in a most exposed position and under heavy fire. On arriving at the aid post, he was informed that a whole machine-gun team were casualties in an advanced position. No stretcher-bearers were available, and he at once went forward and attended to them on the spot under heavy fire. He then returned and worked at his aid post under intense shelling, often attending to cases in the trench outside when the aid post was full. Casualties were being caused all round him, and he was wounded himself, but, though suffering severely, he remained at duty for sixteen hours, until the battalion was relieved. He set a most inspiring example of courage and devotion to duty to all ranks.

AWARDED THE DISTINGUISHED SERVICE ORDER.

Temp. Capt. James Churchill Dunn, M.C., M.D., Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty during an attack. He worked with untiring energy in the open in the front line, searching for and dressing the wounded, and constantly exposing himself to machine-gun and rifle fire. His medical orderlies were both wounded, and the greater portion of his work was done without any assistance. He set a magnificent example to all of courage and devotion to duty under continuous heavy fire and enemy counter-attacks.

Temp. Capt. Ernest Harrison Griffith, M.C., M.D., Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty. He established his dressing-station well forward during an attack, and went up to the front line through a storm of artillery and machine-gun fire utterly regardless of personal safety. He moved about in the open for thirty-six hours without food or rest, attending to the wounded, often leading parties of bearers through heavy barrages until every wounded man had been carried back. He remained behind after the battalion was relieved, still searching for wounded, under heavy fire, though he was several times badly shaken by the explosion of shells. He set a most inspiring example of courage and devotion to duty.

Capt. and Brevet-Major Henry Forbes Panton, M.C., M.B., Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty. The evacuation of casualties, amounting to 60 officers and 1,100 men, after an advance of 3,000 yards was most successfully carried out, chiefly owing to the initiative and sound judgment displayed by him. He spent twenty-four

hours in the forward area, visiting every regimental aid post and sending back hourly reports until the battlefield was completely cleared of wounded.

AWARDED A BAR TO THE MILITARY CROSS.

Temp. Capt. William Thomson Brown, M.C., M.B., Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty. He acted as bearer officer during an action, and was continuously in the open under heavy fire of all kinds. Though several times blown up by shells, he remained at work, and set a most inspiring example of courage and gallantry.

Temp. Lieut. (Temp. Capt.) Henry Alphonsus Harbison, M.C., M.B., Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty. He was in charge of divisional stretcher-bearers during several days' operations. For seventy-two hours he never slept, and was continually on the move under intense shell fire, establishing connexion with the regimental aid posts and leading and directing the bearers. The entire success of the evacuation of stretcher cases from the forward area was due to his magnificent example. His coolness, courage and endurance had a wonderful influence on his bearers. He has rendered conspicuous and valuable service on many other occasions.

Temp. Capt. Charles Reginald Ralston Huxtable, M.C., M.B., Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty. This officer worked for three days and nights under the most appalling conditions helping the wounded, being continually in the greatest danger. He finally collapsed on reaching camp.

Capt. George Reginald Edward Gray Mackay, M.C., M.B., Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty in personally supervising the evacuation of the wounded, making several journeys through a heavy barrage. On many previous occasions he has performed similar acts of gallantry.

Temp. Capt. Charles Joseph O'Reilly, M.C., M.D., Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty in personally supervising the evacuation of wounded, passing and repassing through heavy barrage fire. When a neighbouring medical officer was killed, he attached himself to the battalion and dressed and surpervised the evacuation of the wounded.

Temp. Capt. John Finlayson McGill Sloan, M.C., Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty. He worked continuously for two days dressing over 150 cases in the open under heavy fire, three or four of the wounded being hit by snipers. He showed a fine example of coolness and sense of duty.

Temp. Capt. Gideon Walker, M.C., M.B., Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty. He worked for twenty-four hours after an attack in an advanced area, getting in the wounded of two battalions, and remained in the line after his own battalion was relieved. He showed the greatest contempt of danger under heavy shell fire.

AWARDED THE MILITARY CROSS.

Capt. Charles Henry Brennan, Royal Army Medical Corps, Special Reserve.
For conspicuous gallantry and devotion to duty. He led his bearers fearlessly through heavy shell fire, and made a most valuable reconnaissance beyond the regimental aid post to find out if there were any wounded lying out. Though blown up and gassed, he remained at duty, setting a magnificent example to all.

Temp. Lieut. (Temp. Capt.) Raymond John Clausen, Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty. He worked continuously for forty-eight hours directing the stretcher-bearers and attending to the wounded under continuous shell fire. His cool courage and indomitable energy inspired his men and helped to save many lives.

Capt. George Crawshaw, M.B., Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty. His aid post was twice blown up, but he continued at his work in the open, attending to the wounded under heavy fire with utter disregard of his own safety. He set a magnificent example of courage and devotion to duty.

Temp. Capt. Douglas Erith Derry, Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty. While he was posting stretcher-bearers the locality was very heavily shelled and many men were wounded, but he succeeded in dressing and removing them all under heavy fire. Later, in a small dressing station, when the shelters were hit and damaged by shell fire, he showed a splendid example to all by his coolness and resource.

Temp. Capt. Thomas Duncan, Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty. Though he was wounded on the way up to the line before an attack, he refused to go back, and carried out his duties under most difficult conditions, and though suffering considerable pain, throughout the operations. He was again wounded, but continued at work until ordered to have his wounds attended to.

Capt. Fred Ellis, Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty. He was in charge of stretcher-bearers during an action, and owing to his fearless and capable handling of his men, the evacuation of the wounded was carried out with great success and rapidity. He remained in the open for long periods superintending the work. His disregard of danger and devotion to duty were of the highest order.

Temp. Capt. Andrew Gaston, Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty during an attack. He was untiring in his efforts to attend to the wounded under heavy shell fire and personally brought in many wounded men, often dressing their wounds first in the open. His courage inspired all the wounded with confidence and proved the finest example to his stretcher-bearers.

Capt. William Evans Graham, M.B., Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty when in charge of stretcher-bearers. By his utter disregard of danger he set a splendid example to his men, and carried out the evacuation of the wounded under heavy and continuous shell fire until he was severely wounded.

Temp. Capt. John Lewis Anderton Grout, Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty in conducting a number of stretcher-squads through very heavy shell fire to the aid posts after they had previously failed to get through. Two bearers were killed and three wounded, but by his gallant action over forty stretcher cases were got to safety. Later, he personally conducted squads to these aid posts under similar circumstances.

Temp. Lieut. Henry John Henderson, M.B., Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty. He established his aid post within 300 yards of the enemy's position and dressed and evacuated cases in the open. It was due to his splendid example, cheerfulness and courage that a great number of lives were saved.

Capt. Charles Edward Kynaston Herapath, Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty. During two attacks he was in charge of the evacuation of the wounded from the regimental aid posts. On both occasions he moved about from post to post under very heavy shell fire, encouraging the stretcher-bearers and organizing the evacuation. It was largely owing to his conduct and example that 1,000 cases were got away successfully.

Capt. David Mackie, M.B., Royal Army Medical Corps, Special Reserve.

For conspicuous gallantry and devotion to duty when in charge of a line of evacuation. For four days he worked continuously in the open, going through heavy barrages.

Temp. Capt. John Charsley Mackwood, Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty. He attended to the wounded of eleven units in the open under heavy shell fire, working single-handed for several days. His self-sacrificing devotion to duty and his thoughtfulness and care of the wounded were beyond all praise.

Temp. Capt. William Strelley Martin, M.B., Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty in leading his bearers during seven days' operations through the most intense shelling with infinite resource and regardless of personal safety. It was due to his masterly organization and example that the wounded were collected so promptly.

Temp. Capt. John Louis Menzies, M.B., Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty in working continuously for thirty-six hours dressing and collecting wounded in the open under shell fire. When forced to take refuge his shelter was blown in and he himself badly shaken, and only saved by his steel helmet. He remained at his post, however, until relieved in the ordinary course.

Temp. Capt. James Bertram Mitton, M.B., Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty. When in charge of stretcher-bearers, by his courage and example he was able to get many wounded men away. The district was almost continuously under heavy shell fire and the roads were in a very bad condition; but he overcame all difficulties in a most praiseworthy manner, and set a splendid example of courage and self-sacrifice.

Temp. Capt. John Henry Morris-Jones, Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty. He carried on his duties at his aid post during an enemy attack under very heavy fire. He also visited wounded men who were lying out in the heaviest of the fire, and went up to the front line to attend to the wounded. He showed total disregard of his own safety, and encouraged all by his cheerful and courageous demeanour.

Temp. Capt. Joseph Herbert Porter, M.B., Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty. He was in charge of the divisional collecting post during an action, and by his example and thoroughness did much to encourage all ranks in the discharge of their duties. He went forward in charge of bearers, and by his untiring energy succeeded in getting his communications re-established in the face of great difficulties.

Temp. Capt. Norman Pallister Pritchard, Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty when in charge of his aid post during operations. It was entirely owing to his untiring care of the wounded and exertion in marshalling stretcher-bearers that all were eventually evacuated and lives saved thereby. Most of his work was done in the open under observed machine-gun fire.

Capt. James Purdie, Royal Army Medical Corps, Special Reserve.

For conspicuous gallantry and devotion to duty. When he was informed that there were a number of wounded in the front line during an action he at once went forward with his stretcher-bearers under heavy fire, and remained in the front line dressing and collecting the wounded until all were cleared. He set a fine example of courage and devotion to duty.

Capt. James Rafter, M.B., Royal Army Medical Corps, Special Reserve.

For conspicuous gallantry and devotion to duty in dressing wounded and organizing stretcher-bearers in the open under heavy shell fire during four days' operations without relief. By his splendidly sustained effort he undoubtedly saved many lives and much suffering.

Temp. Capt. Alan Randle, M.D., Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty. He went forward during an action and personally cleared the battlefield of wounded, evacuating 120 cases in two hours under heavy shell fire. He showed great courage when casualties were caused by a bombardment during a relief.

Capt. Hugh Arthur Sandiford, M.B., Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty. He took up a position immediately behind the front line during an attack, and dressed the wounded in the open. He displayed great coolness and gallantry under heavy artillery fire, working in an exposed position for forty-eight hours.

Temp. Capt. William Logan Scott, M.B., Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty. He worked untiringly, attending to the wounded in the open under heavy fire during an engagement, and showed splendid courage and resource.

Capt. Frederic Battinson Smith, Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty. He worked in a shell hole, attending to the wounded, throughout a very heavy bombardment. At night he frequently went out into No Man's Land with parties to bring in the wounded. He showed splendid courage and fearlessness.

Capt. Edwin Cyril Widmerpoole Starling, Royal Army Medical Corps, Special Reserve.

For conspicuous gallantry and devotion to duty. He remained day and night at his post under continuous shell fire, and was untiring in his work on behalf of the wounded, to whom his unremitting care and unruffled calmness was the greatest comfort and assistance. He set a splendid example of courage and self-sacrifice.

Temp. Capt. John Glyndor Treharne Thomas, Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty. He established a forward dressing station in an advanced position during an action, and though heavily shelled throughout the whole day, stuck to his post in a most courageous manner, and undoubtedly saved the lives of many men. He organized search parties, and himself carried in a number of badly wounded men under rifle and machine-gun fire.

Temp. Capt. John Aylmer Tippet, Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty. When his dressing station was blown in, and nearly all the occupants killed, although much shaken, he immediately organized a new station, and for eight hours dressed and tended the wounded without rest. Later, when the battalion moved forward, he went through a heavy barrage to the new dressing station and worked continuously for six hours. During five days he had practically no rest, and dealt with some 300 casualties.

Capt Adam Annand Turner, M.B., Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty. He remained at duty for forty-eight hours under fire and without rest, and succeeded in getting all the wounded away rapidly from the aid posts and forward areas in spite of heavy enemy barrages. He set his men a splendid example of fearlessness and devotion to duty.

Temp. Capt. John Wilfred Watthews, M.B., Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty. His evacuation of the wounded during and after attack was carried out with wonderful organization and skill. He worked continuously for forty-eight hours attending to the wounded under hostile shell fire.

Capt. Harry Whitaker, M.B., Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty. During an action he went forward, and, in spite of heavy shell and machine-gun fire, searched out and dressed the wounded in the most advanced positions. When a counter-attack developed he refused to leave his post until all the wounded had been removed. His courage and devotion to duty were an inspiration to all ranks.

Temp. Capt. Henry Dewi Hampton Willis-Bund, Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty. He was in charge of a dressing station which was destroyed by shell fire. Though rendered unconscious, he continued to attend to the wounded in the open when he recovered, accompanied the battalion into action, and remained at duty for forty-eight hours. He showed the greatest courage and devotion to duty.

War Office,
April 10, 1918.

His Majesty the King has been graciously pleased to approve of the award of a Bar to the Military Medal to the undermentioned Man :—

No. 58097 Pte. (Acting Serjt.) A. J. Tait, M.M., Royal Army Medical Corps (Edinburgh) (M.M. gazetted December 9, 1916.)

His Majesty the King has been graciously pleased to approve of the award of the Military Medal for Bravery in the Field to the undermentioned Non-commissioned Officers and Men :—

ROYAL ARMY MEDICAL CORPS.

No. 433083 Cpl. E. Busby (Dudley).
No. 434053 Pte. W. V. Clarke (Maidenhead).
No. 534388 Pte. H. Clemens (Hackney).
No. 536234 Serjt. H. W. Dalwood (Merton, S.W.).
No. 433106 Pte. E. J. Francis (Birmingham).
No. 21835 Pte. W. N. Hobday (Clapham Park, S.W.).
No. 433094 Lance-Cpl. W. Kettle (Birmingham).
No. 433093 Pte. F. E. Morris (Birmingham).
No. 223 Serjt. (Acting Staff-Serjt.) W. Peake (Laverthorpe, Yorks).
No. 434004 Serjt. (Acting Qmr. Serjt.) R. A. Rogers (Wolverton).
No. 534297 Serjt. C. R. Wellum (Limehouse).

AMENDMENT.

The following is the correct description of the Man whose name recently appeared in the *London Gazette* for the award of the Military Medal :—

No. 103662 Pte. C. E. Buzan, Royal Army Medical Corps. (Gazetted March 19, 1918.)

CHANCERY OF THE ORDER OF SAINT MICHAEL AND SAINT GEORGE.

Downing Street,
April 11, 1918.

The King has been graciously pleased to give directions for the following promotion in, and appointment to, the Most Distinguished Order of Saint Michael and St. George, for Distinguished Services in the Field in connexion with Military Operations, culminating in the capture of Jerusalem. Dated January, 1918 :—

To be Additional Member of the Third Class, or Companion, of the said Most Distinguished Order :—

Col. Richard Harman Luce, C.B., M.B., F.R.C.S., V.D.

War Office,
April 11, 1918.

His Majesty the King has been graciously pleased to approve of the undermentioned rewards for Distinguished Services in the Field in connexion with Military Operations, culminating in the capture of Jerusalem. Dated January 1, 1918 :—

AWARDED THE DISTINGUISHED SERVICE ORDER.

Temp.-Major James Johnston Abraham, M.D., F.R.C.S.; Royal Army Medical Corps.
Lieut.-Col. (Temp. Col.) George Arthur Theodore Bray, Royal Army Medical Corps.
Major (Temp. Lieut.-Col.) Robert John Cahill, M.B., Royal Army Medical Corps.
Lieut.-Col. (Temp. Col.) Ernest Blair Dowsett, Royal Army Medical Corps.
Major (Temp. Lieut.-Col.) Matthew Dunning, M.B., Royal Army Medical Corps.
Col. Evelyn John Robert Evatt, M.B., Royal Army Medical Corps.
Capt. (Acting Lieut.-Col.) Ernest Charles Lambkin, M.B., Royal Army Medical Corps.
Major (Temp. Col.) Hugh Richardson, M.D., Royal Army Medical Corps.
Temp. Lieut.-Col. Henry Wade, M.D., F.R.C.S., Royal Army Medical Corps.

AWARDED THE MILITARY CROSS.

Temp. Capt. Gerald Francis Bird, M.B., Royal Army Medical Corps.
Capt. Philip Stanley Martin, Royal Army Medical Corps.
Capt. Archibald Browning Mitchell, M.B., F.R.C.S., Royal Army Medical Corps.
Capt. James Mitchell Mitchell, M.B., Royal Army Medical Corps.

AWARDED THE DISTINGUISHED CONDUCT MEDAL.

No. 300059 Serjt. W. Davidson, Royal Army Medical Corps (Rothes.)
No. 456014 Pte. J. P. Green, Royal Army Medical Corps (Bath.)

War Office,
April 15, 1918.

The following are among the Decorations and Medals awarded by the Allied Powers at various dates to the British Forces for Distinguished Services rendered during the course of the campaign :—

His Majesty the King has given unrestricted permission in all cases to wear the Decorations and Medals in question :—

DECORATIONS CONFERRED BY HIS MAJESTY THE KING OF THE BELGIANS.

ORDRE DE LEOPOLD.

Chevalier.

Capt. Robert Godfrey Martyn, M.B., Royal Army Medical Corps, Special Reserve.

ORDER DE LEOPOLD II.

Decoration Militaire.

No. 19007 Staff-Serjt. (Acting Qmr.-Serjt.) John Richard Dare, Royal Army Medical Corps (New Kent Road, S.E.).

No. 7705 Pte. Stephen Albert Phillips, Royal Army Medical Corps.

Croix de Guerre.

Capt. Robert Godfrey Martyn, M.B., Royal Army Medical Corps, Special Reserve.

War Office,
April 18, 1918.

The following are among the Decorations and Medals awarded by the Allied Powers at various dates to the British Forces for distinguished services rendered during the course of the campaign :—

His Majesty the King has given unrestricted permission in all cases to wear the Decorations and Medals in question.

DECORATIONS AND MEDALS PRESENTED BY THE PRESIDENT OF THE FRENCH REPUBLIC.

LEGION D'HONNEUR.

Croix de Chevalier.

Col. Georges Etienne Beauchamp, Canadian Army Medical Corps.

Col. Wilfred William Ogilvy Beveridge, C.B., D.S.O., M.B., Army Medical Service.

Croix de Guerre.

Temp. Capt. Ernest Gerald Stanley, M.B., F.R.C.S., Royal Army Medical Corps.

Col. Thomas du Bedat Whaite, C.M.G., M.B., Army Medical Service.

Temp. Capt. George Theodore Cregan, M.C., Royal Army Medical Corps.

Capt. John Francis Edmiston, M.B., Royal Army Medical Corps.

Capt. John Henry Pearson Fraser, M.B., Royal Army Medical Corps.

Capt. Stanley Rider Gibbs, Royal Army Medical Corps.

461455 Pte. Percy John Aslatt, Royal Army Medical Corps (Southampton).

461108 Serjt. Ernest Edward Franmore Bolt, Royal Army Medical Corps (Portsmouth).

12261 Qmr.-Serjt. (Acting Serjt.-Major) John Evans Green, Royal Army Medical Corps (Enniskillen).

Temp. Lieut. Robert John Helsby, Royal Army Medical Corps.

63640 Pte. Henry Clifford Buckham, Royal Army Medical Corps (Newcastle-on-Tyne).

War Office,
April 22, 1918.

His Majesty the King has been graciously pleased to approve of the following awards to the undermentioned Officers in recognition of their Gallantry and Devotion to Duty in the Field :—

AWARDED THE MILITARY CROSS.

Temp. Capt. Cecil Francis Dillon-Kelly, Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty. Establishing his regimental aid post in his captured enemy line, he himself kept in touch with the advanced troops and dressed the wounded under heavy machine-gun and rifle fire. He remained in the most advanced positions, dressing the wounded until every case had been evacuated, and showed an excellent example of disregard for danger and courageous determination.

Capt. Arthur Joseph Gordon Hunter, M.D., F.R.C.S., Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty. His battalion being engaged on both sides of the river at points a considerable distance apart, he repeatedly went out in the face of heavy machine-gun and rifle fire to organize the collection and evacuation of the wounded. His gallant behaviour and magnificent coolness inspired the men working under him with the utmost confidence.

Capt. Louis Laurence McKeever, Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty during an engagement. Hearing that there was no medical officer in the front line, he went forward at once under an intense bombardment and remained in the front line all night attending to the wounded under continuous and violent shell fire. He set a splendid example of courage and devotion to duty.

The amendment which was announced in the *London Gazette*, dated March 26, 1918, is cancelled, and the following substituted :—

Major (Temp. Lieut.-Col.) Charles Algernon Stidston, D.S.O., M.D., Royal Army Medical Corps. (D.S.O. gazetted February 4, 1918.)

War Office,
April 23, 1918.

With reference to the awards conferred as announced in the *London Gazette*, dated December 17, 1917, the following are the statements of Service for which the decorations were conferred :—

AWARDED A BAR TO THE DISTINGUISHED SERVICE ORDER.

Temp. Capt. (Temp. Lieut.-Col.) Charles Derwent Pye-Smith, D.S.O., M.C., M.B., F.R.C.S., Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty when in command of the three field ambulances of the division during ten days' operations. Though the weather conditions were abnormally bad and a large number of the wounded of another division had not been evacuated, owing to his constant presence and influence all the wounded were got away promptly and without assistance from the Infantry.

AWARDED THE DISTINGUISHED SERVICE ORDER.

Temp. Capt. William Howard Lister, M.C., Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty as bearer officer, taking parties to the regimental aid posts, though they suffered heavy casualties on the way. When a regimental medical officer was wounded, he attended to the wounded of this battalion, searching our lines and "No Man's Land" from midday to dark for wounded, and then returned to his field ambulance for another twelve hours' work until relieved.

Australian Imperial Force.

Capt. William Henry Collins, Army Medical Corps.

For conspicuous gallantry and devotion to duty. Finding that his regimental stretcher-bearers were unable to find a regimental aid post which he had established in a German "pill-box" he personally led the first party of them through an intense artillery and machine-gun fire barrage. Although knocked down by a bursting shell, he immediately resumed the dressing of the wounded. Although, owing to casualties, he had only two men to help him, he courageously persevered with his work and himself helped to excavate a dug-out for the wounded under heavy shell fire, during which several of the wounded were killed. He remained on duty for sixty hours, and refused to leave his post till the last wounded man had been evacuated. By his constant cheerfulness under the most averse conditions, and by his utter disregard of his own safety, he kept up the spirits of the wounded and stimulated his surviving helpers to their utmost efforts.

Major Eric Lloyd Hutchinson, Army Medical Corps.

For conspicuous gallantry and devotion to duty when in charge of the evacuation of wounded from the forward area. He led a relief of stretcher-bearers over a track knee-deep in mud and at times over his waisti n water. Another time he led a party through an intense barrage, thus relieving a temporary congestion of the wounded. He had very little rest during the whole four days.

Major Philip Alan Maplestone, Army Medical Corps.

For conspicuous gallantry and devotion to duty. When in charge of all stretcher-bearers and forward posts he showed the utmost coolness under heavy fire, during which several shelters were hit. By his example he prevented any panic and prevented serious casualties from gas shells. Although gassed himself, he remained on duty till the forenoon of the following day, having been on duty for over thirty hours. Even then he refused to be treated as a casualty, but after a short rest he returned to the advanced dressing station and carried on his duties.

AWARDED A BAR TO THE MILITARY CROSS.

Capt. Richard Thompson Cæsar, M.C., M.D., Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty in evacuating the wounded. Under very heavy and continuous fire he systematically searched the battlefield from shell-hole to shell-hole for wounded, until he could report that all casualties had been removed.

Temp. Capt. John Maitland Forsyth, M.C., Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty in going up to the front line several times to search for and tend the wounded under heavy shelling and sniping. It was owing to his tireless energy that the casualties, which were very heavy, were so well evacuated. His aid post was twice hit by shells, once causing nine casualties to his bearers.

Capt. Cyril Jacobs, M.C., M.B., Royal Army Medical Corps (Special Reserve).

For conspicuous gallantry and devotion to duty in forming his dressing station under heavy fire. It was once blown in on top of him and five casualties occurred, but he remained at his post and managed to evacuate all wounded. On the following day he cleared the battlefield in spite of heavy fire, and brought back twenty badly wounded cases.

Temp. Capt. David Henry Russell, M.C., M.D., Royal Army Medical Corps.

For conspicuous gallantry and devotion to duty in successfully evacuating a large number of wounded under constant shelling and in very bad weather conditions. He frequently helped to carry wounded, although himself exhausted.

Temp. Capt. Philip Randal Woodhouse, M.C., M.B., Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty. When the battalion was formed up in the assembly area all the battalion medical staff except himself were wounded. He carried the medical haversacks all day and tended the wounded under fire. He was slightly wounded, but continued to work single-handed for two days.

AWARDED THE MILITARY CROSS.

Temp. Capt. Everard Cecil Abraham, M.B., Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty when in charge of a bearer division during seven days' operations. The rapid and efficient clearing of wounded from the field was largely due to his efforts. During a heavy gas shell bombardment he led his bearers through the barrage to rescue men affected by the gas.

Temp. Capt. William Robert Addis, M.B., Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty in superintending the clearing of wounded from regimental aid posts. The whole area was being heavily shelled, and during the latter part of the period he was gassed, but remained at work until the relief was finished.

Capt. Matthew Thomas Ascough, Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty in dressing wounded in the open for forty-eight hours without sleep or rest, under heavy shell fire, after his shelter had been rendered untenable by four direct hits.

Temp. Capt. Arthur Cecil Barker Biggs, Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty in supervising the removal of the wounded under very heavy fire during two days' operations. It was due to his extraordinary energy that the battlefield was kept clear of wounded, in spite of very adverse conditions.

Temp. Capt. George Alexander Birnie, M.B., Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty. In going forward with two stretcher-bearers to form an advanced aid post he was wounded in the shoulder by a piece of shell, one of the stretcher-bearers being killed at the same time. He continued dressing the wounded in our most advanced line, and even penetrated the enemy line of posts in search of casualties, keeping at his work until relieved some eight hours later.

Temp. Lieut. Charles Herbert Booth, Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty in tending the wounded in the open under continuous heavy shell fire. His skilful organizing of stretcher-bearers was undoubtedly the means of saving many lives.

Tempt. Capt. Robert Briffault, M.B., Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty in organizing an aid post through which all casualties of the brigade, and those of many other units of the division, passed. He personally went up to the post and attended to men lying out in shell holes under very heavy fire. Although relieved, he actually went up beyond our forward posts to search for a wounded officer. Throughout the whole action he showed the utmost disregard of his personal safety.

Temp. Capt. George Edwin Chissell, Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty in tending the wounded both of his own battalion and others and organizing their evacuation. He worked continuously in the open for twenty-four hours under heavy shell and machine-gun fire. When the battalion was relieved he remained until the last of his brigade had been taken away.

Tempt. Capt. Edward James Clark, Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty as medical officer to a battalion. Though continuously under heavy shell fire he moved about in the open attending to the wounded, and undoubtedly saved many lives.

Temp. Lieut. Arthur Philip Draper, M.D., Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty. He set a splendid example of courage and self-sacrifice in attending to the wounded during an action. He went forward and attended the wounded in the open when heavy casualties had been caused among the stretcher-bearers, and by his gallant conduct undoubtedly saved several lives.

Temp. Capt. Frederick Pearson Fisher, M.B., Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty. On learning that the enemy had projected gas into one of our deep mine galleries, he descended to the bottom of the main shaft and established an aid post there. He then advanced with his party into the gassed area and rescued several miners. He remained at his post without relief for fourteen hours and saved many lives.

Capt. Hartas Foxton, Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty when in charge of the collection of wounded. He personally directed and visited all the regimental posts many times a day, often under heavy fire. By his energy he kept his bearers working, though exhausted, until the completion of the evacuation.

Capt. Reginald Douglas Gawn, M.B., Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty. He worked untiringly, attending to the wounded under heavy fire during an attack. He made several journeys over most difficult ground to reach wounded men who were lying out in the open, and showed splendid courage and gallantry throughout.

Capt. Norman Bell Graham, M.B., Royal Army Medical Corps (Special Reserve).
For conspicuous gallantry and devotion to duty. He worked unceasingly under very heavy shell fire, attending to the wounded of several units. He organized stretcher parties and also went out himself to attend to the wounded. He set a splendid example of contempt of danger, and undoubtedly saved many lives.

Lieut. Arthur Robert Hill, M.B., Royal Army Medical Corps (Special Reserve).
For conspicuous gallantry and devotion to duty. He attended to the wounded during an attack in a very exposed position under heavy shell fire. He often moved about over the open searching for the wounded and assisting to move them. He showed great coolness and resource under the most difficult and dangerous conditions.

Capt. William Baly Jepson, Royal Army Medical Corps (Special Reserve).
For conspicuous gallantry and devotion to duty. When a shell had smashed in battalion headquarters, although severely shaken himself, he dug out his commanding officer and the adjutant, and attended to them. He continuously took stretcher-bearers to the front line in daylight through intense shell fire. He established a new forward dressing station after the battalion had been relieved and did not return until he had searched the whole front for wounded.

Capt. Duncan Macfayden, M.B., Royal Army Medical Corps (Special Reserve).
For conspicuous gallantry and devotion to duty. He repeatedly went out to shell-holes under heavy fire to dress the wounded and help bring them in. He attended to the wounded of another battalion in addition to those of his own. He showed splendid courage and self-sacrifice.

Capt. Hugh Agnew Macmillan, M.B., Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty in passing some 600 cases through his regimental aid post though it was heavily bombarded. His staff being much depleted, he had to treat the majority of cases himself.

Capt. James McKay, M.B., Royal Army Medical Corps (Special Reserve).
For conspicuous gallantry and devotion to duty in arranging the evacuation of stretcher cases from the front line. He continually dressed wounded, regardless of heavy shelling, in the open owing to limited accommodation.

Capt. John Pinder, Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty in attending to wounded under continuous shell fire. During two days and nights he worked in a shell-hole and sent back a large number of wounded men who would otherwise have died from exposure. He also went forward several times to the front line to attend to wounded men.

Temp. Capt. Charles Leslie Grove Powell, Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty in carrying on his work in the open under fire, though his advanced aid post was a special target for the enemy's artillery. He also visited the front line when it was being heavily shelled, to attend to cases that could not be moved.

Lieut. (Temp. Capt.) William Leonard Eliot Reynolds, Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty in working continuously for twenty-four hours amongst the wounded. In addition to his work at the Regimental Aid Post he went to the front line frequently, by day and night attending the wounded under heavy fire.

Capt. William Jack Scade, M.B., Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty. When there was a large number of wounded in the aid post and no stretcher-bearers were available, he went back a distance of over a mile through a very heavy barrage, brought back stretcher-bearers and removed all the wounded. On the following day he went up to the front line under snipers' fire and brought back several wounded men. His courage and initiative were the means of saving many lives.

Capt. Charles Nixon Smith, M.B., Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty when in charge of the collection of casualties from the whole of the divisional front during active operations. For seven days he worked unceasingly without adequate sleep or food, and it was largely owing to his personal influence that the exhausted bearers were able and anxious to remain at work for so long a time.

Temp. Capt. William Steadman, Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty in superintending the loading of wounded men on to the tramway, and in assisting the stretcher-bearers, under heavy fire. He also repeatedly went in search of wounded, and was the means of bringing a large number to safety. Later, though gassed, he continued at duty.

Temp. Capt. Frederick Naylor Stewart, M.D., Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty. He attended to the wounded during an action with utter disregard of danger, working in the open most of the day under persistent shell fire. He was untiring in his efforts on behalf of the wounded, and showed splendid courage and determination.

Temp. Lieut. (Temp. Capt.) Robert Ievers Sullivan, M.D., Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty in attending the wounded under heavy fire. He organized the stretcher-bearers, and for thirty-six hours searched in front of our out-posts for wounded men, thoreby saving many lives.

Temp. Capt. Norman Charles Talbot, M.B., Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty. On hearing that the batteries of the brigade were being heavily shelled, he dashed forward and dressed and collected over twenty wounded men.

Capt. Robert Fowler Walker, M.B., Royal Army Medical Corps (Special Reserve).
For conspicuous gallantry and devotion to duty in tending the wounded in the open after the aid post had become a target for the enemy's howitzers. He was severely wounded, but would not allow the bearers to remove him until he had given instructions to his N.C.O., and made all possible arrangements for the care and comfort of the wounded.

Temp. Capt. Henry Currie Watson, M.B., Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty in working continuously for three days at an advance dressing station which was being constantly shelled. Although gassed he persisted in remaining at duty.

Temp. Lieut. Robert Everard Whitting, M.D., Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty. He attended to the wounded during an engagement continuously for forty hours, working most of the time in the open under heavy shell fire. His courage and devotion to duty undoubtedly saved a very large number of lives.

Temp. Capt. Frederick Edward Saxby Willis, Royal Army Medical Corps.
For conspicuous gallantry and devotion to duty in tending the wounded of his own and other units in advance of our front line and in forward positions which were fully exposed under heavy fire. It was largely due to his careful training and skilful arrangements that his bearers evacuated such a large proportion of the wounded of three units from the front area during the two days.

Australian Imperial Force.

Capt. Walter Leonard Smith, Army Medical Corps.
For conspicuous gallantry and devotion to duty while in charge of stretcher-bearers and posts. He did magnificent work in attending to the wounded and organizing their removal, and by his fearlessness and determination set a splendid example to his stretcher-bearers.

New Zealand Force.

Lieut. Robert Hector Baxter, Medical Corps.
For conspicuous gallantry and devotion to duty in working for three days at his regimental aid posts under continual exposure to shell and machine-gun fire.

Capt. Frederick William Lumsden, Medical Corps.
For conspicuous gallantry and devotion to duty in dressing wounded in the open when the regimental aid post, which was within 700 yards of the enemy "pill-boxes" and in full view of them, was still full of wounded left by the previous battalion. Casualties were inflicted even on the stretcher cases. Though exposed to this fire, he worked unremittingly for three days with practically no sleep and very little food until quite exhausted.

Capt. John McGhie, Medical Corps.
For conspicuous gallantry and devotion to duty when in charge of bearers. Time after time he took stretcher parties forward through heavy mud and enemy barrages to the regimental aid post, and did not stop till he was certain that all men lying out had been collected.

Capt. Sydney Devenish Rhind, Medical Corps.
For conspicuous gallantry and devotion to duty for three days and nights at his regimental aid post, repeatedly having to attend to men outside under heavy fire. He also organized parties of stretcher-bearers for their removal.

Capt. Samuel Llewellyn Serpell, Medical Corps.
For conspicuous gallantry and devotion to duty in attending to the wounded at the regimental aid post under heavy fire. Although twice wounded, he went on with his work until ordered to hospital by his commanding officer.

South African Force.

Temp. Capt. Alistair Gordon Forbes, Medical Corps.
For conspicuous gallantry and devotion to duty. After continuous dressing of thirty wounded he personally took a place in one of the squads of bearers under heavy fire of gas and other

shells, and so stimulated his exhausted bearers to special efforts. Though suffering from mustard gas-poisoning, he remained at work until ordered back as a casualty two days later.

Note.—Since the publication of these Officers' names in the *Gazette* of December 17, 1917, promotion has in some cases been conferred, and the ranks herein shown are not therefore in all cases those now held.

ARMY MEDICAL SERVICE.

The undermentioned Colonels to be Major-Generals:—

(Temp. Major-Gen.) Oliver R. A. Julian, C.B., C.M.G., *vice* Major-Gen. F. J. Jencken, retired, dated April 4, 1918.

Stuart Macdonald, C.M.G., M.B., *vice* Major-Gen. H. G. Hathaway retired, dated April 7, 1918.

(Temp. Major-Gen.) Maurice P. C. Holt, K.C.M.G., C.B., D.S.O., *vice* Major-Gen. Sir F. H. Treherne, K.C.M.G., retired, dated April 15, 1918.

The undermentioned Lieutenant-Colonels from the Royal Army Medical Corps to be Colonels:—

Dated April 7, 1918.—(Brevet-Col.) Thomas W. Gibbard, M.B., K.H.S.; William E. Hardy.

Dated April 15, 1918.—Henry N. Dunn, C.M.G., D.S.O.

Dated April 25, 1918.—Edward M. Morphew, D.S.O.

Lieut.-Col. John Grech, D.S.O., relinquishes the temporary rank of Colonel on re-posting, dated March 7, 1918.

The undermentioned Lieutenant-Colonels to be Temporary Colonels whilst employed as Assistant Directors of Medical Services of Divisions:—

Norman Faichnie, M.B., dated March 7, 1918.

Bernard B. Burke, D.S.O., dated March 16, 1918.

Col. (Temp. Major-Gen.) Bruce M. Skinner, C.M.G., M.V.O., retired list, relinquishes his te nporary rank, and is granted the honorary rank of Major-General, dated April 25, 1918.

ROYAL ARMY MEDICAL CORPS.

Brevet-Col. Henry Aylmer Haines, M.D., is placed on retired pay, dated May 2, 1918.

The undermentioned Temporary Captains to be Acting Majors, dated January 4, 1918:—

Herbert A. Lake.
Lieut. (Temp. Capt.) Galvin A. E. Argo, M.B.
Tremlett B. Batchelor.
Henry Moore, M.C.
Alexander W. Rattrie, M.B.
Arthur Richmond, M.C., M.B.
Lieut. (Temp. Capt.) Henry A. Harbinson, M.C., M.B.
Albert F. Mavety, M.B. (from January 4 to January 29, 1918).
Francis J. O. King, M.B.
Lieut. (Temp. Capt.) Harold A. Rowell, M.C.
Duncan M. Morison, M.B.
Geoffrey T. Baker (from January 4 to January 15, 1918).
Alan R. Finn, M.D., F.R.C.S. (from January 4 to February 9, 1918).
Augustin P. Fry, M.B. (from January 4 to February 15, 1918).
Walter S. Danks, M.D.
John Gibson, M.B.
Victor L. Connolly, M.C., M.B.
John B. Lowe.
Lieut. (Temp. Capt.) Raymond J. Clausen, M.C., M.B.
William T. Brown, M.C., M.B.
George D. R. Carr, M.C.
James F. Robertson.
Archibald S. K. Anderson, D.S.O., M.C., M.B.
Hugh Young, M.B.
Herbert H. Sampson, M.C., M.B., F.R.C.S.
John Anderson, D.S.O., M.B.
Sidney J. Rowntree,
William Rankin, M.B.
Frederick B. Manser, M.B.
James D. Hart, M.C., M.B.
Alexander Mearns, M.B.
Henry W. Batchelor.
Bertram H. Barton, M.C., M.D.
Herbert H. Warren, M.B.
Harold R. Grellet.
Herbert M. Vickers, M.B.
George Buchanan, M.B.
William J. A. B. Wishart, M.B.
David S. Brough, M.C., M.B.
Francis H. McCaughey, M.B. (from January 4 to February 15, 1918).
Robert C. Irvine, M.B.
Sol. Cross, M.B. (from January 4 to March 8, 1918).
Francis de S. McMenamin, M.B.
James A. Doull, M.B.
Robert Svensson, M.B.
Maurice A. Power, M.C., M.B.
John B. Haycraft, M.B.
John S. Arkle, M.B.
Richard C. Alexander, M.B., F.R.C.S.Edin.
Arthur T. Edwards, F.R.C.S.
Harold B. Day, M.C., M.D.
Arthur W. H. Donaldson, M.B.
Joseph B. Cook, M.D.
Richard Charles, F.R.C.S.I.
Thomas C. Ritchie, M.B.
Wilfred G. Mumford, M.B., F.R.C.S.
Allan G. Hamilton, M.B., F.R.C.S.Edin.
Francis G. Bell, M.C., M.D., F.R.C.S.
Richard T. Worthington, M.B.
Thomas I. Bennett, M.B.
Stanley G. Luker, M.D.
Charles L. T. Arthur, M.D.
Harold Dunkerley.
Lieut. (Temp. Capt.) James La F. Lauder, D.S.O., M.C.
Hubert F. Wilson, M.C., M.B.
John P. Davidson, M.C., M.B.
Joseph S. Doyle, M.B.
George E. Neligan, M.C., M.B., F.R.C.S.
Anson R. Jordan, M.B., F.R.C.S.
John H. Thornley, M.B.
William Anderson, M.B., F.R.C.S.

Dated January 13, 1918.—William F. Morgan.
Dated January 17, 1918.—Francis C. Lees.
Dated January 29, 1918.—Francis F. Fahy, M.B.; Harold B. Day, M.C., M.D.
Dated February 3, 1918.—Cecil A. Boyd, M.B.; Harold W. Scawin.
Dated February 12, 1918.—Charles B. Davies, M.C.
Dated February 17, 1918.—Victor H. Mason, M.C., M.B.
Dated from February 23 to March 1, 1918.—William A. Hislop, M.B.
Dated February 23, 1918.—Victor B. Kyle, M.D.
Dated February 25, 1918.—Hugh B. German, M.C.
Dated March 1, 1918.—Robert M. Greig, M.B.
Dated March 6, 1918.—John R. P. Allin; Vivian M. Rich, M.B.: Robert B. Rutherford, M.B.; William C. Douglass.
Dated March 9, 1918.—John E. Davies.
Dated March 15, 1918.—Henry W. Turner.
Dated March 20, 1918.—Philip Carney, M.B.
Dated March 22, 1918.—Arthur Sunderland; (Temp. Lieut.) Hyam Goodman, M.B.; Robert J. B. Madden, M.C., M.B.

Temp. Capt. Clement R. Macleod, M.C., M.B., relinquishes the acting rank of Major on re-posting, dated March 21, 1918.

The undermentioned Captains to be Acting Majors, dated January 4, 1918:—

William McK. H. McCullagh, D.S.O., M.C., M.B.
Cyril J. B. Way, M.C.
Reginald H. Leigh, M.C.
Charles M. Page, M.B., F.R.C.S.
Percy B. Corbett, M.B. (from January 4 to March 6, 1918.
John Inkster, M.D. (from January 4 to March 1, 1918).
Thomas W. Clarke, M.C., M.B.
(Brevet-Major) Ronald C. Ozanne, M.B.
Bernard Goldsmith.
Ernest M. Cowell, M.D., F.R.C.S.
William McN. Walker, M.B.
James C. Young, M.D. (from January 4 to February 22, 1918).

Dated February 21, 1918.—Robert A. Flood, M.B.
Dated March 6, 1918.—John Rowe, M.B.; Noel T. Whitehead, M.C., M.B.

The undermentioned to be Acting Major, dated January 4, 1918:—
Temp. Major Gordon Taylor, M.B., F.R.C.S.

Capt. George H. C. Mold, M.B., relinquishes the acting rank of Major on re-posting, dated March 8, 1918.

Henry Mearns Savery, from University of London Contingent, O.T.C., to be Lieutenant, dated April 22, 1918.

The undermentioned Majors to be Lieutenant-Colonels:—

Dated March 29, 1918.—Arthur R. C. Parsons.
Dated April 4, 1918.—Eyre W. Powell.
Dated April 7, 1918.—Charles H. Carr, M.D.; Edmund Bennett.
Dated April 15, 1918.—Arthur C. Adderley.
Dated April 25, 1918.—Sir Edward S. Worthington, Kt., C.M.G., M.V.O.

Major Reginald V. Cowey, D.S.O., relinquishes the acting rank of Lieutenant-Colonel on re-posting, dated March 18, 1918.

The undermentioned to be Acting Lieutenant-Colonel:—
Major (Brevet Lieut.-Col.) Barry A. Craig, whilst in command of a Medical Unit, dated January 18, 1918.

The undermentioned to be Acting Lieutenant-Colonels whilst specially employed, dated March 29, 1918:—
Temp. Major Donald K. McDowell, C.M.G.; Capt. Ernest B. Lathbury.

Major Travis C. Lucas, M.B., is placed on the half-pay list on account of ill-health contracted on Active Service, dated April 3, 1918.

The undermentioned Temporary Captains to be Acting Majors whilst specially employed, dated March 29, 1918:—

Frederick J. Thorne, M.B.
Oswin Shields, M.D.
William F. Abbott.
Walter Fell, M.D.
Harold K. Graham Hodgson, M.B.
Butler Hogan.
Aubrey K. H. Pollock.

Maurice Craig, M.D., F.R.C.P., to be Temporary Lieutenant-Colonel, dated May 1, 1918.
The undermentioned relinquish the acting rank of Major on re-posting:—
Temp. Capt. David S. Brough, M.C., M.B., dated February 22, 1918.
Capt. Raymond J. Clausen, M.C., M.B., dated March 8, 1918.
Temp. Capt. Cyril A. Bernard, M.C., dated March 19, 1918.
Temp. Capt. Guy W. Parry, M.C., dated March 28, 1918.

ROYAL ARMY MEDICAL CORPS COMFORTS AND PRISONERS OF WAR FUND.

THE Honorary Treasurer thinks that the following list of contributions from companies and units at Home and Abroad to our Prisoners of War Fund will be of general interest to the Corps.

Owing to the very large number of donations it is impossible to show the gifts from individual Officers and other friends and the present list of units is only amounts received up to the end of April. It is hoped to publish other lists at an early date.

All donations are acknowledged at once either by the Honorary Treasurer or the Honorary Secretary, and contributors may rest assured that all money sent is expended solely for Prisoners of War, as the Ladies' Committee have decided to suspend entirely the supply of Comforts to the Units in the Field whilst we have men of our own Corps in captivity.

E. M. WILSON, *Lieut.-Colonel*,
Hon. Treas., R.A.M.C. Comforts and Prisoners of War Fund.

LIST OF COMPANIES AND UNITS'—AT HOME AND ABROAD—CONTRIBUTIONS TO PRISONERS OF WAR FUND IN 1918.

January—			
Proceeds of concert by "V" Company R.A.M.C. Training Centre, Blackpool	£12	1	6
R.A.M.C. Training Centre Details (late Ripon Training Centre)	150	0	0
Officers' Mess ,, ,, ,,	10	13	8
R.A.M.C. Depot, Blackpool	100	0	0
February—			
Training Brigades R.A.M.C., Blackpool	35	12	1
Regimental Institutes R.A.M.C., Blackpool	500	0	0
March—			
R.A.M.C. Training Centre Details, Blackpool	100	0	0
,, ,, ,, ,,	14	17	2
Regimental Institutes:			
No. 7 Company, Devonport	10	0	0
No. 10 Company, Chatham	20	0	0
No. 2, General Hospital B.E.F., France	10	0	0
15 Company, Belfast	2	0	0
April—			
7th Training Battalion, Blackpool	5	0	0
No. 1 Company, Cambridge Hospital	50	0	0
No. 1 Company, Cambridge Hospital, Sergeants' Mess	10	0	0
Officers' 3rd Scottish General Hospital, T.F.	13	5	0
317 Field Ambulance	10	0	0
Officers' Headquarters Staff A.M.S. Southern Command, Salisbury	8	14	0
24th Sanitary Section	1	10	0
April—			
61st Casualty Clearing Station	£88	0	0
53rd General Hospital	60	1	1
103rd Field Ambulance	20	0	0
Col. H. Ensor and Officers' Mess, 8th F.A.	19	0	9
Central Military Hospital, Eastbourne	5	6	0
Milford Haven Garrison R.A.M.C.	2	6	0
16 Company, R.A.M.C., and 134 F.A. (T.F.), Limerick	10	0	0
39th Stationary Hospital, B.E.F., France	25	0	0
King George's Military Hospital, Dublin, Officers, N.C.O.s and Men	83	12	6
5th Southern General Hospital, T.F.	5	5	0
Belfast Ulster Volunteer Force Hospital	3	3	0
Officers' Mess, 58th Scottish General Hospital	13	0	0
334 1st London Field Ambulance	5	0	0
139th St. John's Field Ambulance	5	10	0
2/1st North Midland Field Ambulance	20	0	0
34th Field Ambulance	5	10	0
135th Field Ambulance	22	0	0
No. 8, General Hospital, B.E.F., France	25	0	0
No. 9 Company, R.A.M.C., Colchester, and detachments	181	10	0
47th Field Ambulance, B.E.F., France	18	6	8
25th Stationary Hospital, B.E.F., France	11	5	2

ROYAL ARMY MEDICAL CORPS CENTRAL MESS FUND.

THE Annual General Meeting of Subscribers to the Royal Army Medical Corps Central Mess Fund will be held in the Library of the Royal Army Medical College on Monday, June 10, 1918, following immediately that of the Royal Army Medical Corps Officers' Benevolent Society. The Director-General will preside. Officers desiring information about this Fund are asked to communicate with the Honorary Secretary beforehand, so that there may be no delay in dealing with any questions which may be asked. Notice of any definite proposal which it may be desired to bring forward should be sent to the Honorary Secretary in order that it may appear on the agenda paper.

3, *Homefield Road*,
Wimbledon, S.W.

J. T. CLAPHAM, *Captain*,
Honorary Secretary.

ROYAL ARMY MEDICAL CORPS FUND (Regular Army). ROYAL ARMY MEDICAL CORPS OFFICERS BENEVOLENT SOCIETY (Regular Army).

THE Annual General Meeting of the Royal Army Medical Corps Fund will be held in the Library of the Royal Army Medical Corps College, Grosvenor Road, S.W., at 2.30 p.m., on Monday, June 10, 1918.

The Director-General will preside.

It is hoped that all subscribers who can spare the time will be present, and will freely express their views on any point connected with the Fund.

The Annual General Meeting of the Royal Army Medical Corps Benevolent Society will take place immediately afterwards.

Any officers desiring information regarding these Funds are requested to communicate with the Secretary beforehand, so that there may be no delay in dealing with any questions asked.

124, *Victoria Street, S.W.* E. M. WILSON, *Lieut.-Col., Secretary.*

EXCHANGES, &c.

The charge for inserting Notices respecting Exchanges in the Royal Army Medical Corps is 5/- for not more than five lines, which should be forwarded by Cheque or P.O.O., with the notice, to Messrs. G. STREET and CO., Ltd., 8, Serle Street, London, W.C., not later than the 22nd of the month.

Notices.

EDITORIAL NOTICES.

The Editor will be glad to receive original communications upon professional subjects travel, and personal experiences, etc. He will also be glad to receive items of news and information regarding matters of interest to the Corps from the various garrisons, districts, and commands at home and abroad.

All such Communications or Articles accepted and published in the "Journal of the Royal Army Medical Corps" will (unless the Author notified at the time of submission that he reserves the copyright of the Article to himself) become the property of the Library and Journal Committee, who will exercise full copyright powers concerning such Articles.

Matter intended for the Corps News should reach the Editor not later than the 15th of each month for the following month's issue. Notices of Births, Marriages, and Deaths are inserted free of charge to subscribers and members of the Corps. All these communications should be written upon one side of the paper only; they should by preference be type-written; but, if not, all proper names should be written in capital letters (or printed) to avoid mistakes, and be addressed: The Editor, "JOURNAL OF THE ROYAL ARMY MEDICAL CORPS," 324, Adastral House, Victoria Embankment, E.C. 4.

A Communication has been received from Lieut.-Col. W. E. Lunn.

The following publications have been received:—

British: The Medical Press and Circular, Journal of the Royal Naval Medical Service, Tropical Veterinary Bulletin, St. Bartholomew's Hospital Journal, The Journal of State Medicine, The Hospital, The Medical Journal of Australia, Guy's Hospital Gazette, Edinburgh Medical Journal, The Journal of Tropical Medicine and Hygiene, The Indian Medical Gazette, The Medical Review, The British Journal of Nursing, The Indian Journal of Medical Research, The British Journal of Tuberculosis, Tropical Diseases Bulletin, The Practitioner, Recalled to Life, Bulletin of the Canadian Army Medical Corps, The Hospital, The Royal Engineer's Journal, The Medical Journal of South Africa.

Foreign: Archives de Médecine et Pharmacie Navales, Bulletin de l'Institut Pasteur, Bulletin de la Société de Pathologie Exotique, Archives de l'Institut Pasteur de Tunis, Journal of Agricultural Research, Archives Médicales Belges, Memorias do Instituto Oswaldo Cruz, Le Caducée, Office International d'Hygiène Publique, Giornale di Medicina Militare, Mededeelingen van den Burgerlijken Geneeskundigen Dienst in Nederlandsch-indië, Colonies et Marine, United States Journal of the Department of Public Health, Surgery, Gynæcology and Obstetrics (U.S.A.).

A free issue of twenty-five reprints will be made to contributors of Original Communications, and of twenty-five excerpts of Lectures, Travels and Proceedings of the United Services Medical Society.

Any demand for reprints, additional to the above, or for excerpts, must be forwarded at the time of submission of the article for publication, and will be charged for at the following rates, and additional copies at proportionate rates:—

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	8	0 7 6	0 3 6						
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The back outside cover is not available for advertisements.

MANAGER'S NOTICES.

The JOURNAL OF THE ROYAL ARMY MEDICAL CORPS is published monthly, six months constituting one volume, a volume commencing on 1st July and 1st January of each year.

The Annual Subscription is £1 (which includes postage), and should commence either on 1st July or 1st January; but if a subscriber wishes to commence at any other month he may do so by paying for the odd months between 1st July and 1st January at the rate of 1s. 8d. (one shilling and eightpence) per copy. (All subscriptions are payable in advance.)

Single copies can be obtained at the rate of 2s. per copy.

The Corps News is also issued separately from the Journal, and can be subscribed for at the rate of 2s. (two shillings) per annum, including postage. Subscriptions should commence from 1st July each year; but if intending subscribers wish to commence from any other month, they may do so by paying for the odd months at the rate of 2d. per copy. (All subscriptions are payable in advance.)

Officers of the Royal Army Medical Corps possessing Diplomas in Public Health, etc., are kindly requested to register their special qualifications at the War Office. Letters of complaint are frequently received from officers stating that their special qualifications have not been shown in the Distribution List which is published as a supplement to the Journal in April and October of each year. As, however, the particulars of this list are supplied from official sources, officers are reminded that unless the possession of Diplomas, etc., has been registered at the War Office, no entry of such qualifications can be recorded in the Distribution List.

Letters notifying change of address should be sent to the Hon. Manager, "Journal of the Royal Army Medical Corps," 25, Adastral House, Victoria Embankment, E.C. 4, and must reach there not later than the 20th of each month for the alteration to be made for the following month's issue.

It is requested that all Cheques or Postal Orders for Subscriptions to the Journal, Corps News, Reprints, etc., be crossed "Holt & Co.," and made payable to the "Hon. Manager, Journal R.A.M.C.," and not to any individual personally.

All communications for the Hon. Manager regarding subscriptions, etc., should be addressed to

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